SCIENTIFIC AMERICAN

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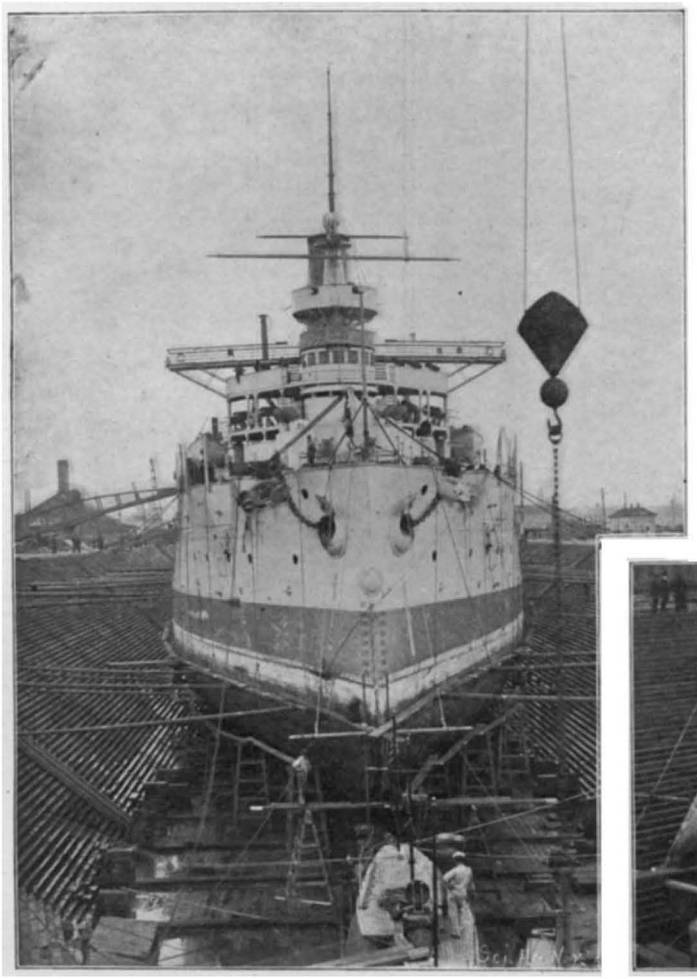
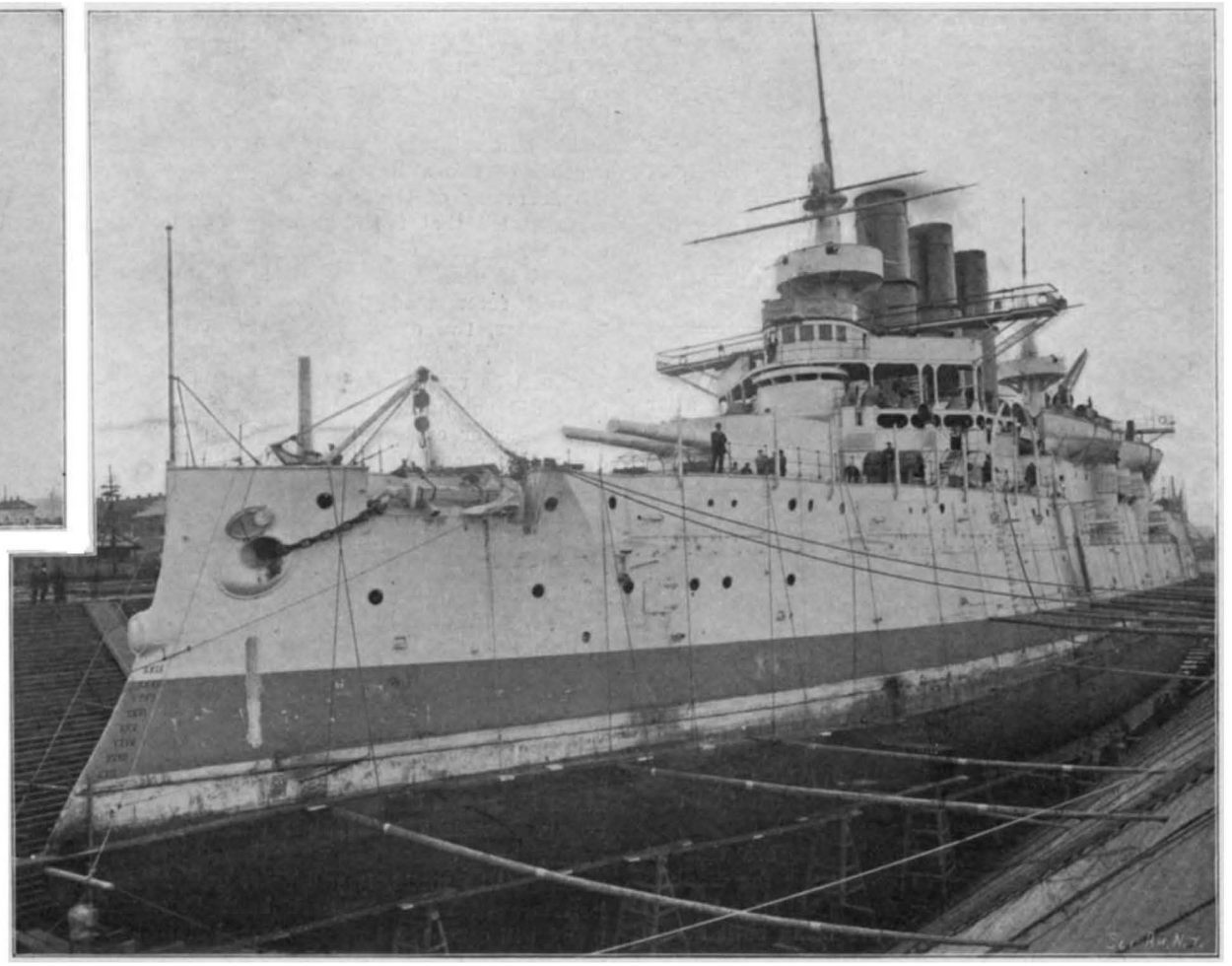
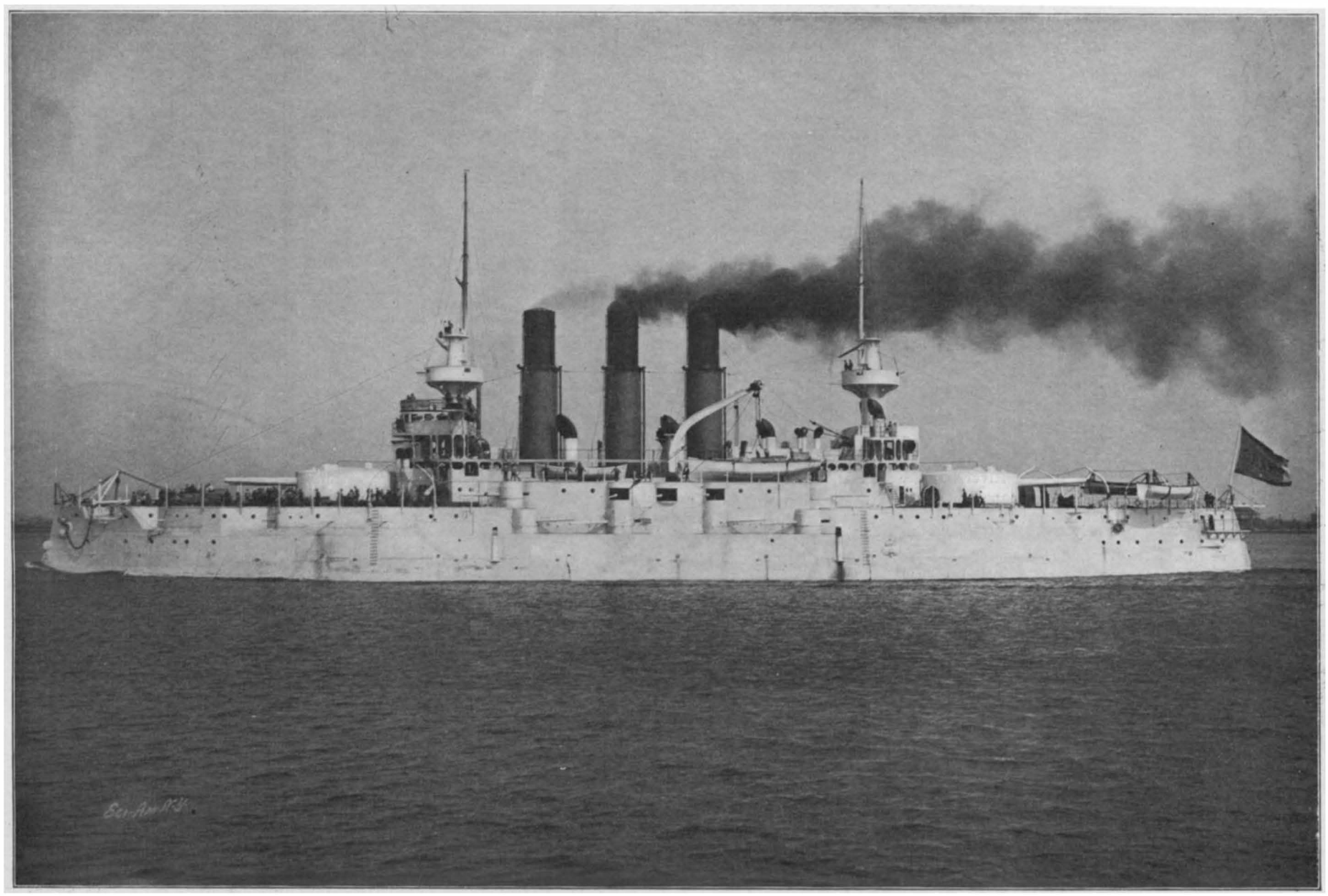


Bow View.



In Drydock at the Brooklyn Navy Yard.



Displacement, 12,700 tons. **Speed,** 18·8 knots. **Maximum Coal Supply,** 2,000 tons. **Armor:** Belt, 9 inches; turrets, 10 inches; deck, 2 to 4 inches. **Armament:** Four 12-inch 40-caliber; twelve 6-inch 45-caliber; twenty 3-inch; twenty 3-pounders; six 1-pounders. **Torpedo Tubes,** four (two submerged). **Complement,** 600.

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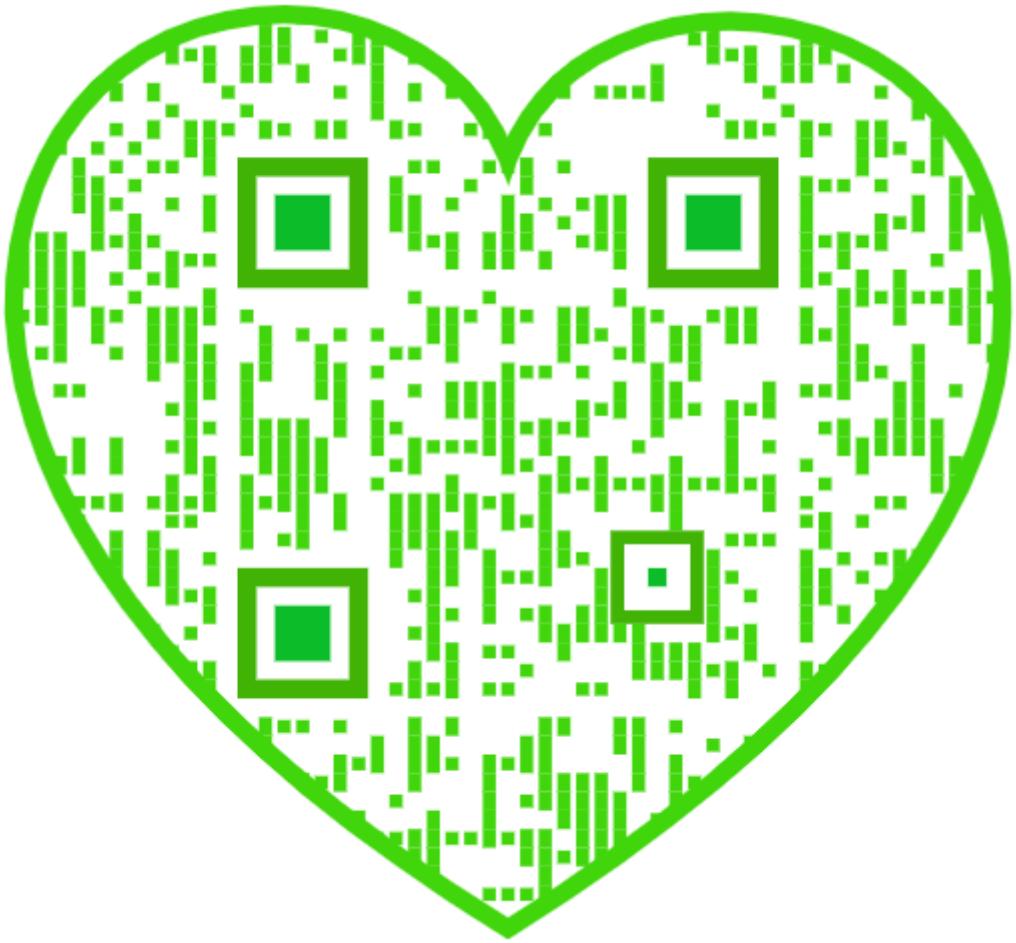
THE "RETVIZAN"—AMERICAN-BUILT BATTLESHIP FOR THE RUSSIAN NAVY.—[See page 263.]



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NEW YORK, SATURDAY, OCTOBER 26, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PROPOSED RELIEF OF THE BROOKLYN BRIDGE TERMINAL.

It must be confessed that the plans which, after six months' work, have been drawn up by the engineers who were appointed to devise the best means for relieving the crush at the Manhattan terminus of the Brooklyn Bridge, are distinctly disappointing to the New York public. Of all conceivable remedies, it was certainly not expected that these experts would seek relief for the Bridge by adding more elevated structures to those which already disfigure the streets of the city and encumber its traffic. When we learn that the so-called improvements (which include, forsooth, an elevated structure down the already-crowded Park Row, across Broadway and down Vesey Street, passing the venerable and sacred inclosure of St. Paul's Church and Churchyard) are to cost three million dollars, the conviction is forced upon us that the disease is preferable to the remedy.

The recommendations, briefly stated, are that an elevated road be constructed connecting the Manhattan terminus of the Brooklyn Bridge with the termini of the two new bridges which are being built across the East River.

That a double-track elevated road be built down Park Row, across Broadway and down Vesey Street, to West Street, and the Cortlandt Street ferry.

That the second floor of the Brooklyn Bridge terminal be used exclusively as a trolley-car terminal; that a new stairway be made to the Bridge from Rose Street; that the present stairway from William Street on the south side be widened and a corresponding stairway be built on the north side; and, finally, that across the whole length of the Brooklyn Bridge the trolley tracks be separated from the driveway by curbing.

With regard to the proposed elevated structures between the three bridges and to the Cortlandt Street ferry, the last-named is, for reasons of unsightliness alone, altogether out of the question. Moreover, we very much doubt whether there is sufficient cross-town travel from the Bridge to the ferry to warrant the construction of a special elevated road to accommodate it. As to the proposition to connect the three bridge termini, it would surely be wiser to await the opening of these bridges and ascertain just what will be the natural flow of travel across and between them, before making any provision to handle or divert that travel on the Manhattan side. The construction of this elevated system would be very much in the nature of a leap in the dark, and as the new East River Bridge, if it is completed under an honest and capable administration, will be opened in less than two years' time, we think it would be wiser to wait at least that long before moving in this matter. So much for the proposed extensions (as they would actually be) of the Brooklyn Bridge trolley lines.

The other recommendations of the engineers, affecting the bridge itself, are, we think, generally to be commended, and the removal of the trolley-track loops to the second floor of the Bridge would be advisable, even if the elevated Bridge extension should never be built. The footway approach to the Bridge would be cleared of obstruction and dangers, and the car and foot-passenger travel would be placed on separate floors. The provision of extra stairways and the enlarging of the present stairways are also greatly needed. The proposition to place a curb for the full length of the Bridge between the trolley track and the roadways, however, is an improvement, the advantage of which would lie entirely with the trolley roads. Its object, of course, would be to prevent vehicles from pulling out onto the trolley tracks, in passing the slower vehicles ahead. At present a swiftly traveling carriage, if it overtakes a heavy dray, has to pull out onto the tracks if it wishes to move ahead. Although this is done continually, we have noticed that vehicles never remain longer on the trolley tracks than is necessary. Of course, the practice may occasionally cause delay to a trolley car, but the delay is slight and comparatively infrequent. If a curb were laid down, as suggested by the engineers, it would limit the space available for vehicles to 8 feet, and a dray moving at two or three miles an hour would have the whole of the traffic behind it at its mercy for the twenty minutes or more that it takes to cross from Manhattan to Brooklyn.

NAVAL ESTIMATES.

The naval estimates for the fiscal year ending June 30, 1903, call for a total appropriation of just under ninety million dollars. This is about twenty million dollars more than the appropriations for the current year. The principal increases are one of about two and a half million dollars for new construction, and another of two million dollars for armor. Although the Secretary of the Navy, in speaking of the estimate, stated that it did not cover any recommendations for increase of the navy over that already authorized, it is considered probable in naval circles that he will recommend the construction of three new battleships, two armored cruisers and several small gunboats.

It will be remembered that, although the last Congress did not authorize the construction of any new battleships or cruisers, the Construction Bureau was ordered to prepare plans for two battleships and two armored cruisers. The plans for these battleships are those over which such an animated controversy has been waged lately in the Naval Board on Construction, the majority of the Board being opposed to the incorporation of double-decked turrets in these designs, and adopting a plan which included four 12-inch guns in turrets and twenty 7-inch rapid-fire guns mounted in broadside. Plans for the two armored cruisers were also completed. The three new battleships and two armored cruisers recommended by the Secretary will be built from the above designs. If appropriations are made for these five ships, the naval list of the United States will show that we have twenty first-class battleships, under construction or authorized. Compared with the other first-class navies of the world, it will place us second to Great Britain, which has forty-one battleships, while Germany will come third with sixteen, followed by Russia with fourteen, France with thirteen, Italy with ten, and Japan with six. This preponderance in battleships is one of the most encouraging features in any comparison that we make of our standing with that of other navies; for although France and Russia very greatly exceed our navy in the total number and total tonnage of ships of all classes, and Germany about equals us, it must be remembered that it is the battleships that will have to stand the first and last shock of battle, and that by their numbers and excellence must be determined the ultimate issue of a great naval war. The Secretary is in favor, also, of the construction of a dozen gunboats, a type of vessel which, because of its light draft, he considered to be of special value for service on distant stations and in our new colonies.

Among other items of importance in the estimates, we notice the following: For reserve guns for the ships of the navy, $500,000; for a floating drydock at Portsmouth, N. H., $500,000; and for new works at the Boston navy yard, $1,127,700; while for the New York navy yard the estimates call for an expenditure of over $3,000,000, in which is included $2,000,000 for the purchase of land, and $200,000 for barracks for the enlisted men. Over a million is asked for the Norfolk navy yard; the estimates for the naval station at San Juan call for over two and a half million dollars, the improvements including a new masonry drydock to cost a million dollars. Appropriations are also asked for a naval station at Tutuila, Samoa, for the Cavite naval station near Manila, and for a complete new naval station at Olongapa.

It will be observed that a considerable portion of the appropriations is rendered necessary by the enlarged responsibilities and wider field of operations of the navy, due to our West Indian and Philippine possessions. The naval stations are an absolute necessity, for, in case of our being plunged into a naval war, drydocks, coaling stations and store depots would be just as essential to the efficiency of our ships as coal and ammunition. Although the sum asked for is a large one, we must remember that the country is being favored with a period of unparalleled prosperity, and that the increase in appropriations does not begin to equal our expanding commercial activity, and our phenomenal increase in wealth.

VIBRATIONS OF LONDON UNDERGROUND.

The new London underground electric road has been giving considerable trouble of late in the way of vibrations. It will be remembered that the trains circulate, from the City to Shepherd's Bush, in tunnels formed of cast-iron tubes 11 feet in diameter situated at an average depth of 60 to 75 feet below the street. Since the trains have been running a great many complaints have arisen from the inhabitants of the houses along the route, and it is stated that the vibrations are sufficiently marked to have caused cracks in several buildings. No such effect of vibrations has been noticed for the other underground systems. A special commission was appointed to look into the matter and has lately made its report. The commission, after a careful examination of the locality, is convinced that serious vibrations are produced in a number of houses situated along the route of the Central London Railway, and their experiments lead to the conclusion that these vibrations are due to two causes: first, the too great proportion of non-suspended weight in the locomotives, and second, the want of rigidity of the rails. In order to obviate the first difficulty the company has ordered a new type of locomotive which is shortly to be tested. On the other hand, the engineers are studying the means of giving greater rigidity to the rails. When the results of these tests have been made clear, the committee will be in a position to indicate the measures to be taken in order to suppress the vibrations on the Central London system, as well as the rules to be imposed in the case of new concessions. In any case the committee is of the opinion, according to the present experiments, that by taking special measures the vibrations of the new lines projected on the tubular system may be practically suppressed, but cannot indicate the exact measures to be adopted before the present tests are finished.

MINING CONDITIONS IN SOUTH AFRICA.

Representatives from a large number of mining companies of South Africa have recently arrived in this country, and report that, in all probability, the output of gold from the Transvaal will not for many years equal the amount reached when the Boer war began. In August, 1898, 483,000 ounces of refined gold was produced. The output at the present time is merely nominal. In anticipation of the early cessation of hostilities, and immediately after the capture of Johannesburg by the British, large orders for material were sent by the companies to replace that which had disappeared or deteriorated during the enforced idleness of the war; but the supplies, though received at adjacent ports, have not been forwarded, owing to the continued raids of the Boer forces. The warehouses at Delagoa Bay and Durban are crowded with these shipments waiting for a conclusion of hostilities. Even were there no interruption to railroad traffic, mining could not be resumed at once on account of the dispersal of the laborers, both black and white. In October, 1898, the mines employed 116,000 black "boys" and 10,000 whites, and of these not more than 20 per cent are left. The balance have either disappeared or emigrated.

The condition of the 51 milling plants on the reef which were in operation at the beginning of the war is good. Only one was destroyed, though several of the plants were run by the Boers to provide funds for defensive purposes. Those mines producing the highest grade ore suffered most. The highest number of stamps working was in October, 1898, between 4,000 and 5,000, having increased from 3,567 in 1897.

The value of the surface plants of the mines of the reef is estimated at $125,000,000, and the cost to place them in as good condition as when closed down is estimated at fully 40 per cent of the original value.

The purpose of the visit of the South African mining agents to the United States is to inspect the latest improvements in deep mining. The introduction of electrical hoisting on the Comstock has greatly interested them, and will lead to the general adoption of this agent as a motive power in South Africa, though cheap water power is not accessible there. The latest improvements in shaft-driving have been sought, and in some instances orders for such machinery have been given.

The agents say there is no improvement in gold-mining adapted to South African conditions that the companies are not prepared to adopt. They admit that their initiative and suggestion of improved mining methods comes from the United States, which supplies them with the latest inventions and most efficient machinery.

It is said as soon as peace is assured that South African mining development will reach enormous proportions. Outcroppings of the Johannesburg extend for a length of 45 miles, with base dimensions of unknown breadth or depth. The "Catlin" shaft, near Elandsfontein, 8 by 28 feet, has been sunk to a depth of 3,750 feet, and is now the deepest in South Africa. It will be continued until the reef is intersected. At its present depth the rock temperature is 80 deg. At Turfontein a diamond drill has struck the reef at a depth of 4,800 feet, and a shaft equal in dimensions to the "Catlin" will be sunk immediately. Projects are being entertained to sink to depths of 10,000 feet, or even more, if necessary. South African engineers are willing to undertake these abnormal projects, provided there is a reasonable assurance of

the existence of ore bodies at these depths. Heat conditions such as are present in the Comstock lode are said not to abound in the Transvaal.

It is said that superficial indications point to the existence of great ore bodies in Rhodesia, and confident assertions are made that the wonderful production of the Johannesburg mines will be exceeded in a few years by those of the newest of British provinces.

FEEDING THE WILD ANIMALS.

The feeding of wild animals in captivity, so that they will thrive and grow contented in their confinement, has become a pretty accurate science in modern times, and the keepers of wild animals in zoological parks, menageries, and circuses, have attained such success in this direction that it is rarely an animal dies because of improper feeding. Twenty-five years ago this was not the case. The mortality among menagerie animals was considerable, and the losses were so great that a systematic inquiry was made in regard to the feeding of wild animals in captivity. Partly as the result of that inquiry, and partly because of the accumulating experience in handling the animals, present methods of feeding have practically eliminated all danger to the animals from the food they may eat.

Yet it has been an easy question to solve. In a wild state the carnivorous animals are gluttons when they can find the food, but their restless activity prevents any troubles from indigestion or over-feeding. Likewise the reptiles gorge themselves with food, and then sleep off the effects for days at a time. In captivity these same tendencies are apparent, but wisdom has taught the keepers not to feed the animals until they were stuffed. This in confinement is not suited to their health. Regular feeding in prescribed quantities has been found the most satisfactory, and the animals are, as a result, kept in much better condition than when roaming wild, gorging themselves with food one day, and starving for a week a little later. If all other conditions of cage life agreed with the wild animals as much as this regular, systematic feeding, the longevity of the creatures would undoubtedly be much greater than their kind allowed to live in their natural habitats, subject to all the uncertainties of food supply.

The feeding of wild animals, birds, and fish in any large park or menagerie is consequently of scientific interest and value. Something less than $30,000 worth of food is needed annually for the animals, birds, and fish in the public parks, menageries, and aquariums in the limits of Greater New York. A close analysis of the food purchased by this considerable sum shows that the largest amount of the money is spent for meat, fish, and fowl. There are altogether some forty to fifty different kinds of food used, and all of it is as good as the market affords. The common idea that scraps and waste food can be fed to wild animals is hardly consistent with modern menagerie experience. Such food would in a short time cause sickness and disease among the animals in captivity. Hence all the food is carefully selected, and is of the very best. In feeding the animals fish the greatest danger comes from ptomaine poison. Several fine otters and seals have been lost through feeding them with fish that had become tainted. The seals, sea-lions, otters, and pelicans are great consumers of fish, and they are fed every morning with medium-size herring, packed fresh in ice and delivered daily at the Zoological Park. When it is impossible to secure good herring, other fish are purchased and cut up, if too large, to suit the fastidious creatures who live on a fish diet. These fish-eating animals and birds are very susceptible to poor food, and any violent change in the quantity or quality of it almost instantly causes sickness. Probably more sea-lions have been lost to zoological gardens in the past through insufficient knowledge concerning their food than any other class of valuable specimens. The slightest taint of the fish produces symptoms which usually terminate in sickness and death.

The snakes are also very susceptible to the kind of food given them, and they prove extremely fastidious creatures when held in captivity. It is impossible to supply some of the reptiles with the special food they like, and substitutes are not taken kindly to at first. Thus the big cobras in their native haunts live chiefly on other snakes—the small harmless varieties. Now it is manifestly impossible to secure sufficient small snakes to supply these voracious eaters at all seasons of the year. Nevertheless, the keepers of the Central Park Menagerie and the Zoological Park in the Bronx make great efforts to collect small snakes for the valuable cobras. These come from different points in considerable numbers, shipments often amounting as high as 150 at a time. Fed on these lives snakes the cobras thrive in captivity and appear satisfied with their lot; but it becomes necessary to appease their appetite with rats and mice when snakes are scarce. While new cobras will not touch these rodents when they are first placed before them, they can sometimes be enticed to swallow them when tied to the tail of a small snake or even when stuffed in the skin of a dead reptile.

The other snakes are fed mostly on toads, mice, and rabbits. Even English sparrows are purchased in considerable numbers for the reptiles. The average prices paid each year for these snake foods are two cents each for sparrows, four to five cents each for toads and frogs, and two to three cents for live mice. At these quotations many boys make quite a little pocket money, and the Zoological Park managers find the supply at times greater than the demand, so eager are the youngsters to feed the snakes. In the winter season, however, it sometimes becomes a question of considerable importance how to secure fresh food for the reptiles. At one time more than a dozen rattlesnakes had to be killed because of the keepers' inability to find plenty of live mice to keep them from starvation.

The wild carnivorous animals of the jungle need a certain amount of meat each day, and if they had their tastes always gratified they would accept nothing else; but stale bread is fed to them in addition to the meat. The bears, monkeys, and other beasts of the jungle learn to eat bread with evident relish, but the lions and tigers look forward eagerly to their fresh meat, and are not satisfied until it comes. About the usual feeding hour each day these creatures grow restless and pace anxiously up and down their cages. The appearance of the keeper with their dinner is a signal for whines and growls, and when the fresh meat is thrown to them they snap and snarl surlily until they have disposed of it. Horse flesh has been found an excellent meat for these animals, and a cheap food at that. It probably forms the principal diet of the lions and tigers in Central Park, while the Zoological Garden bears receive a limited amount of "chuck" beef every day.

There is a great variety of food given to the other animals, and the mess department of the Park is an interesting place. There the cooks are preparing for the apes and monkeys custards and puddings made out of tapioca, oatmeal or rice; chopping meat and fish for the aquatic turtles, and preparing vegetarian compounds for the land tortoises. There are great quantities of cabbages, melons, squashes, and lettuce piled up for daily use for a long list of creatures which never touch any flesh or insects. The birds have immense granaries where hemp, rape, and other seeds are stored. Every morning a butcher delivers at the storage house a huge basket of chicken heads, which have been chopped off in the markets for use at the menagerie. These fresh heads are fed to the foxes, which eat them greedily, and to some of the small carnivora. Roots and vegetables and fruits of all kinds are collected there. These are fed to the elks, deer, buffaloes, birds, monkeys, and many other creatures to keep their systems in good order. They represent a sort of medicinal food to counteract any evil effects of the heavier diet.

Hay, oats, wheat, and corn naturally form a considerable part of the daily diet of the elephants, rhinoceri, hippopotami, and similar herbivorous animals. Only the very best hay and grain in the market are purchased for this purpose. The annual bill for hay, straw, wheat, bran, middlings, and meal for the ruminants amounts to something like $2,600 for the New York Zoological Park; and for meat, fish, and fowl heads, $3,500. Live fowls, rabbits, sparrows, mice, rats, frogs, and fish for the reptiles cost about $2,400, and a similar amount is required for seeds, fish, meat, vegetables, and grain for the birds. Over $1,200 is spent for nuts, seeds, grain, bread, and dog cakes for the rodents, and $1,850 for bread, milk, fruit, eggs, and vegetables for the apes and monkeys. The annual diet costs the Park about $14,000, while that for the animals and birds in the Central Park menagerie costs $12,000. The food for the Aquarium costs about $2,400, and the few animals kept in the Brooklyn parks are maintained at an annual expense of less than a thousand dollars for the food.

G. E. W.

ROOF GARDENS ON PRIVATE HOUSES.

The Hospital calls for the construction of glass-roofed rooms at the tops of private houses, where children may receive the benefit of open-air play free from the dust and dirt of the street. It says:

"The desirability of children passing a considerable portion of their time in the open air is manifest, while unfortunately it is equally manifest that in most cases town children cannot obtain fresh air without inhaling the foulest of dust. Infinitely better would it be for a child to play about in its roof conservatory, as it could do for hours every day, than to take its perfunctory 'walk' or be wheeled through the London streets at a level of only about thirty inches from the ground. We notice that at a recent meeting of the American Pediatric Society, Dr. Northrup reported that by his advice a sun-room had been built on the roof of a private house in New York, a playroom in which fresh air and sunlight can be enjoyed without dust, and free from the dangers of the streets, and that the family for whom the structure was built had had the satisfaction of finding that their child, who had been very delicate, grew up strong and well. But our suggestion is not merely to build a playroom on the roof, but to make this glass-covered room itself form the roof of the building, much as a weaving shed is made to form the roof of a mill in the textile factories in the north of England."

SCIENCE NOTES.

The committee having in charge the awarding of the Pollok prize has decided that none of the devices shown at Havre are worthy of the large award. Therefore there will be another competition held at some future date.

Petrolan, says Parfumeur, is a mineral soap, the active principle of which is an ichthyol-like compound. It occurs in bituminous rock in the Caucasus, is of a dark color and of the consistence of an ointment, soluble in ether, and does not turn rancid. It finds application in the treatment of diseases of the skin, such as eczema, acne, psoriasis, etc. It acts as an antiseptic and drying agent without producing irritation of the skin.

M. Santos-Dumont made another flight on October 19 and made the trip from St. Cloud around the Eiffel Tower and return in 30 minutes 40 4-7 seconds. As the guide rope was not seized at the starting point until this time elapsed, he really lost winning the Deutsch prize by a technicality, as the trip only took twenty-nine minutes, thirty seconds. It is possible that the technical committee, which meets October 22, will award him the prize, which is morally his already.

The Kress airship was tested at Tullnerbacher, Lower Austria, a few days ago. The air ship was propelled by a 22-horse power motor. The idea of Herr Kress, who has been working upon the problem for over twenty-five years, was to sail first on the water, and when the propellers drive the airship at a speed of 35 feet a second it would rise and sail in the air. He found on trial that when sufficient speed was reached the airship would rise, but when it was only a few feet above the surface a terrific squall turned it over and it went to the bottom of the lake. Herr Kress had on a life belt and so escaped drowning.

The English Chancellor of the Exchequer proposes the levy of an import tax upon diamonds. It is estimated that the output of the De Beers syndicate in South Africa alone amounts to $20,000,000 per annum, while a large quantity is also imported from Brazil. Therefore a large sum would be realized, even at 10 per cent, from this source of revenue. The principal difficulty that militates against the maturing of such a scheme is the collection of the tax, but it is anticipated that this difficulty will be easily overcome. It is stated that the result of such a tax will be to drive the diamond-cutting industry to the Continent of Europe. The major portion of the diamonds dispatched to Britain are in their raw state, and it is not expected that the cutting firms would pay 10 per cent upon the raw material, but would establish markets for their goods upon the Continent where no such taxation exists. The Continental retailers would also have the advantage of being able to dispose of their goods 10 per cent cheaper than the English vendor.

Dr. Allan Sturge delivered a very interesting address before the British Association for the Advancement of Science held at Glasgow, on "The Stone Age of Man and his Coexistence with the Ice Age." After alluding to the researches of Archbishop Ussher and Prof. Flinders Petrie, he recounted his own investigations on the subject. He exhibited some stones that he had himself discovered, and which he estimated were fashioned thousands of years before patination occurred. Patination, he explained, alone takes thousands of years to mark the stones in the manner in which those he had discovered were marked. The scratches on the stone he adduced to the effect of ice, and the flint must have been fashioned by a paleolithic man some thousands of years before those glacial epochs which come round once in every 20,000 years. An interesting discussion followed, mainly led by Dr. John Evans, the celebrated archeologist. Dr. Evans severely criticised Dr. Sturge's theories, and explained away the supposed patination marks as due to the chemical constitution of flints; the peculiar strata in which they had been found; or possibly its utilization by the paleolithic man for scraping oily matter from animals' skins, by which means the flint had become impregnated with sufficient oil to permit it to resist patination for an interminable length of time. He also endeavored to point out that the scratches supposed to be due to patination were not actually the results of the action during the glacial period, but were due to the presence of sand.

A CLEVER PIECE OF MOLDING.

The accompanying photograph, for which we are indebted to Mr. John W. Kelton, foreman of the N. C. & St. Louis Railway, represents an ingenious and

A REMARKABLE WORK OF MOLDING.

Single brass casting, representing "the old oaken bucket."

unique piece of mechanism, the work of Mr. Daniel Galvin, of Paducah, Ky., a skilled artisan and a molder of more than local repute. The casting is of brass, and represents his interpretation of the old but ever-popular song, "The old oaken bucket, the iron-bound bucket, which hung in the well." The entire representation, from the bottom of the pedestal to the top of the caption, with the one exception of the buckets and chain, was done at a single cast, and therein is the charm of this pretty toy. The dimensions of this truly admirable piece of mechanism are 12 inches high by 4 inches square, the well house being 2¾ inches high, 2 inches long, and 1½ inches wide. We are informed that it has elicited much favorable local comment, both as regards its intrinsic merit, and as a display of remarkable ingenuity in the art of molding.

A WOODEN SMELTER STACK.

By the courtesy of Mr. A. Rica, general manager of the Compañia Minera de Peñoles, we are able to present illustrations of a lofty smoke-stack of most unique construction. The stack was built by the above-named company at Mapimi, Durango, Mexico, some four years ago, at a cost of only $10,000 Mexican currency. Wood was used in its construction, because of its cheapness, and because of the distance of the smelter from the nearest brick works. The saving in cost will be seen when it is stated that a stack of similar capacity, built in brick, would have cost fully $40,000. The stack is 180 feet in height and the dimensions of the flue are 10 x 10 feet. The flue proper is constructed of one-inch matched flooring lumber, and the whole of the inside is lined with No. 22 corrugated roofing iron. As is clearly seen from the illustration, the stack is secured against overturning by a system of inclined wooden bracing, consisting of posts, ties, and waling pieces, which closely resemble, in the method of framing, the tall timber trestles which are used so largely on our Western railroads. The bracing is built chiefly of 4 x 6 and 6 x 6 inch lumber with a small number of 8 x 8 sticks. The inclined posts are carried down to a footing which consists of stout timber trestles, as shown in the illustration. The whole of the work was completed in six weeks' time by Mexican labor, the only white men employed being the contractor and a carpenter. The cost of the lumber laid down at Mapimi was $60 per thousand feet board measure. The fumes from the smelter are carried off by means of a masonry conduit, which is shown clearly in the illustration. Of course, the most serious risk in a stack of this kind is that from fire, and to control any outbreak, a platform has been erected at every 40 feet of the height of the stack, and on this platform is a length of hose, which is connected to a 2-inch water main. Should the corrugated iron lining burn out and the timber be attacked, the smoke issuing from the side of the stack gives timely notice, and it has proved a simple matter to extinguish the fire before any serious injury was done to the stack. We are informed that the corrugated iron is standing the test of service, and that the stack is to-day in good condition, although it has been carrying off for three years the arsenical fumes from four to six 60-ton blast furnaces.

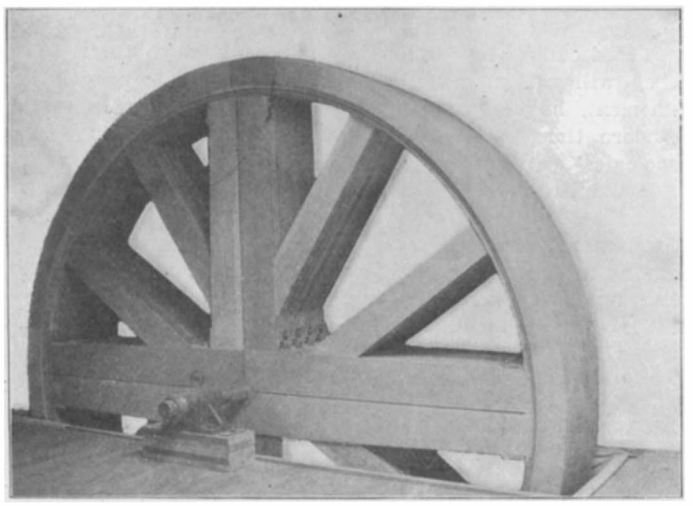
Interior dimensions, 10 feet by 10 feet; height, 180 feet.

WOODEN SMELTER STACK AT MAPIMI, MEXICO.

An interesting type of vessel has been launched from the yard of Messrs. Smith & Co., shipbuilders, of Newcastle-on-Tyne, England, to the order of the River Tyne Commissioners. It has been specially designed and equipped for the purpose of dealing with the extensive system of moorings on that river. The work which this vessel will have to carry out is of a most varied description, such as driving screw moorings into the bed of the river; lifting and paying out cable chains; examining and repairing moorings; assisting in salvage operations, and so forth. The vessel is 80 feet in length with a beam of 25 feet and a depth of 8 feet 6 inches. She is divided into four watertight compartments, with pumping equipment for sinking and raising the craft, as the exigencies of the cases may require. She is built of steel with a strong superstructure suitable for the handling of heavy gear and buoys, and has a massive bow davit with a lifting capacity of 40 tons. She also carries a crane swinging through an 18-foot radius, and capable of lifting 5 tons. The boat is supplied with a center well 10 feet square, through which opening the appliances pass for connecting the screw mooring at the bottom of the river to the capstan.

A LARGE WOOD PULLEY.

Wood pulleys, by reason of their superior frictional qualities, are being used in large numbers and of all



A LARGE WOOD PULLEY.

sizes. Split wood pulleys can also be secured to the shaft without taking the shaft down, as they are built in two or more sections. One of the largest all-wood, belt-transmission wheels running in the United States has recently been constructed by the Reeves Pulley Company of Columbus, Ind. It is made in quarters, and the whole pulley is built up of a large number of pieces of southern Indiana oak. Its diameter is 16 feet, the face is 31 inches, and the bore 8¼ inches. Its exact weight is 13,440 pounds. Compression bolts at the hub serve to bind the various sections together.

Consul-General Hughes, of Coburg, reports that a railway to connect Iwakopmund and Windhoek, in German Southwest Africa, is in course of construction. Last year, 194 kilometers (120 miles), from Iwakopmund to Karibib, were completed, and traffic was opened on that portion a few months ago. For the fiscal year 1901, 3,000,000 marks ($714,000) have been appropriated for continuing the line toward Windhoek. After the whole line is completed, it is planned that two freight trains shall be run daily and two passenger trains weekly. Twenty-eight double engines and four single engines will be provided for that purpose; the latter are principally to help the trains up steep grades. In the construction of the passenger cars particular care will be taken to offer every possible comfort and protection to travelers, who otherwise would have to suffer severely in the hot climate of that region. It is proposed that seats shall be provided which, by turning, can be converted into beds. The cars will be protected by sunshades, dark glass, and window screens. Stations will be established at Iwakopmund, Windhoek, Okahandja, and Karibib. The last, being well provided with good water, will be the central and repair station of the new line.

A new railway for connecting the center of Africa with the sea has been sanctioned by the British government, from Chiromo to Blantyre in the British Central Protectorate. Blantyre is the center of the coffee-growing country, which is one of the most extensive industries in this part of Africa. It has, however, suffered keenly from the want of rapid communication with the sea, for the growers have been unable to transport their produce expeditiously to the coast, and have also been unable to have their stores, provisions, and agricultural implements dispatched to them with the requisite celerity. This new railroad, however, will place Blantyre in direct communication with the sea, and will result in great developments of this the richest part of East Africa.

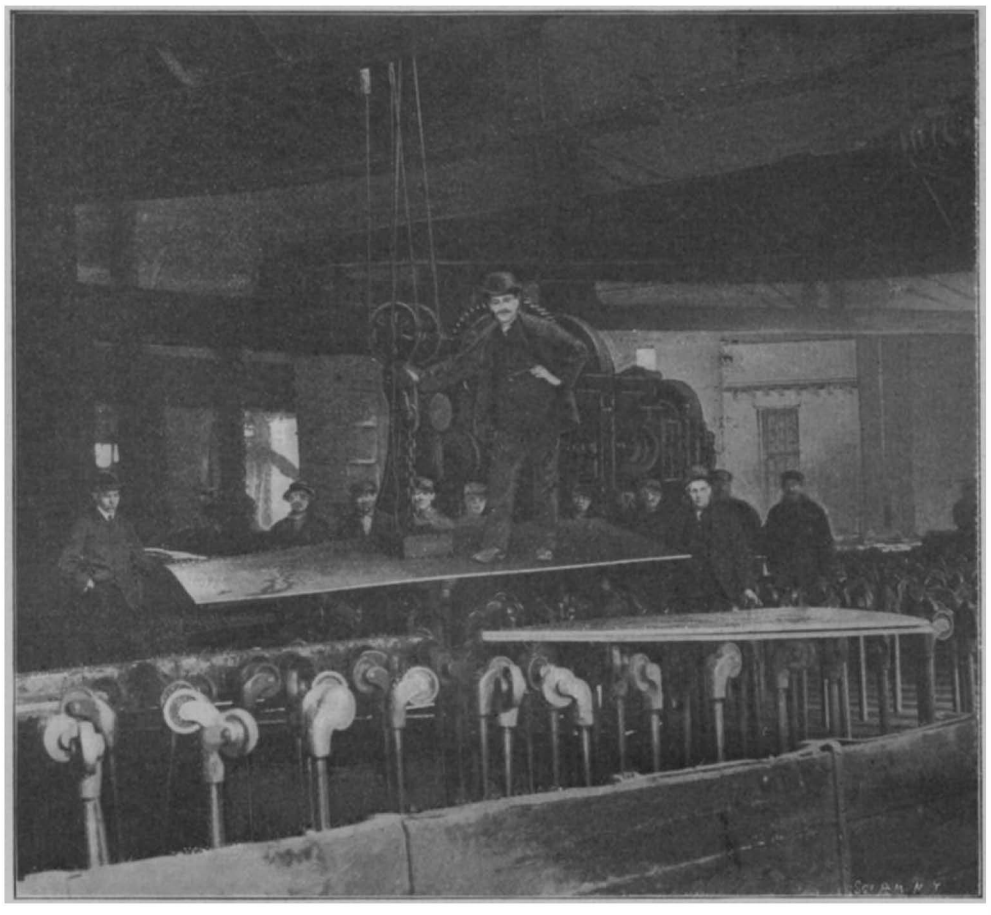
ELECTRIC LIFTING MAGNETS.

One of the newest and most ingenious devices for the speedy and economical handling of material in great manufacturing plants which has been introduced in the industrial world is the lifting magnet. There are several different types of the apparatus, but they differ only in detail. These magnets are, to a certain extent, a development of the idea embodied in the toys with which children pick up needles and other bits of steel, but each is directly connected with an electrical power transmission line which furnishes the current for holding the metallic material against the face of the magnet while the latter is being raised or lowered or moved from place to place. The magnets are now employed not only in the ordinary handling of steel and iron plates, bars, billets, etc., but also in stacking or placing them in racks and in loading them into or unloading them from railroad cars.

The operation of the magnets is simple in the extreme. The magnet is attached to the hook of a crane and connected to the main wires of a crane circuit, or if preferred it can be installed on an independent circuit, direct-connected with the dynamo. The magnet is lowered on to the material to be lifted, the current turned on and the hoist raised, whereupon the plate, billet, or other form of material is lifted by the magnet. When the load has been brought to the proper place it is lowered into position, the current cut off and the magnet raised, or if desired the load can be dropped without the magnet being lowered.

A very striking example of the possibilities of the new lifting devices is afforded at the yard of the New York Shipbuilding Company at Camden, N. J., where all the cranes designed for use in handling ship plates are equipped with electro-magnets, the magnet in each case being controlled by the engineer of the crane. Thus, instead of its being necessary, as has heretofore been the case in shipyards, to employ a gang of half a dozen laborers to lift with crowbars each plate to be moved while a chain is slipped underneath, and then go with the plate to its place of deposit and release the chain by a similar process, only one man is required in addition to the engineer. The latter brings the electro-magnet over the plate, turns on the current, and the plate, now the armature of the magnet, may be lifted and carried to any part of the shop. At the outset of the experiments with the lifting magnets it was found that there was a remote possibility of danger always present, from the fact that the current might at any time be cut off in the dynamo room without warning, but this is guarded against in most plants by the use of current from a storage battery.

In many cases a crane operator can load and unload material by means of the magnets without any assistance whatever from other operatives. The saving in time and labor in the handling, stacking, loading and unloading of steel or iron plates, bars, slabs, billets, ingots, etc., is variously estimated at from fifty to seventy-five per cent, although in the handling of plates a still greater saving is attainable. Otherwise expressed, the utilization of one of these labor-saving devices ordinarily means a saving of the services of from three to five men, and the work may be performed in less than half the time. In many minor ways, too, the new plan of handling material is an improvement. For instance, there is no necessity for the loss of time consequent to shifting the chain in order to get the load to balance, as commonly had to be done under the old system of handling plates, and moreover experiment has proved that magnets will actually lift and handle material where a chain would slip.

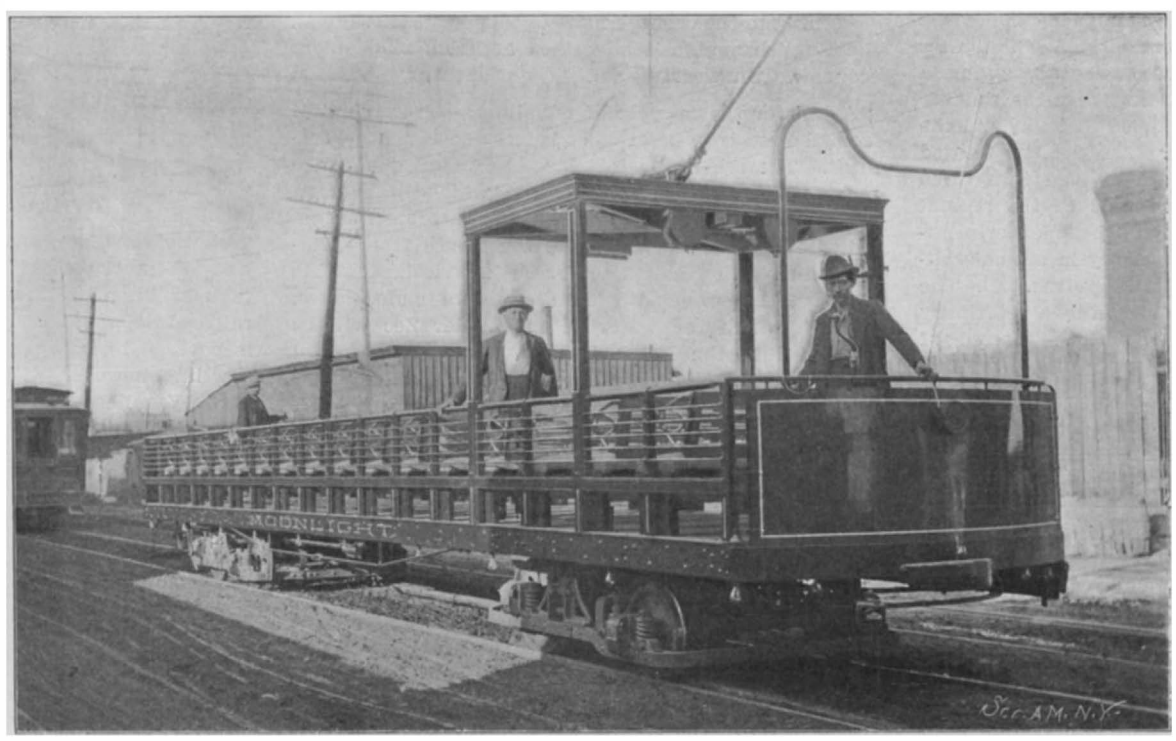


HANDLING PLATES AT THE SHEARS BY LIFTING MAGNETS.

In handling billets or other material of similar shape, two, three, four or even more pieces, up to the full length of the magnet, can be picked up and handled at one time. In handling small thin plates, the current from the magnet will pass through a number of them, lifting several plates at a time. If, on the other hand, a magnet picks up more plates than required, the excess can be dropped off, one at a time. If desired, also, the magnet may be so designed as to only pick up one plate at a time.

In plants where the electro-magnets have been introduced, a rather unique method has in some instances been followed in handling boiler heads and other thin plates. Piles of plates lying flat have been tilted to one side, so that the lifting-face of the magnet could come in contact with the edges of the material, and thus quite a number of pieces have been transferred from one place to another simultaneously. In handling long plates two or more magnets are used, in order to prevent bending or sagging. It has been discovered also that by the exercise of a little care magnets may be dropped on a plate in such a manner as to raise the plate from a flat to a vertical position and successfully handle it in this position or deposit it in a rack.

The ordinary magnets have a lifting capacity of five tons each. However, they are seldom if ever taxed to their full capacity. At a recent test a single magnet lifted five billets, each weighing 240 pounds, and later lifted a billet 15 inches by 15 inches by 5 feet in size and weighing 3,820 pounds. Then four billets, each weighing 145 pounds, were moved by the magnet, after which three billets, each weighing 730 pounds, were moved; and finally six billets, each weighing 730 pounds, were raised and transported. Owing to the size of the material, three magnets were utilized to lift a 3,000-pound steel plate over twenty-seven feet in length and nearly a yard wide, and the three magnets also raised a plate of this size from a flat position preparatory to placing it in a rack on edge.



ST. LOUIS NIGHT EXCURSION CAR "MOONLIGHT."

A NIGHT EXCURSION CAR.

There seems to be no end to specialties in the way of cars for street railways. The increase of mileage around our great cities has resulted in creating a great demand for excursions, and it is possible in many places to travel eight or ten miles for five or ten cents, and the trolley has even invaded Fairmount Park, passing through some of the most delightful sections of that great pleasure ground.

The St. Louis Transit Company has constructed a special roofless summer car, for hot weather service, running to Creve Cœur Lake each evening. The car is appropriately named "Moonlight" and is built much on the lines of the ordinary summer car, except that no part of it comes between the passengers and the sky. It was built under the supervision of the master mechanic of the St. Louis Transit Company in the shops of the company, and is 46 feet 5 inches long and 8 feet 2¼ inches wide. It is equipped with sixteen cross seats and can comfortably accommodate ninety-six passengers.

The tower which supports the trolley stand is not roofed over; this enables every passenger to have an unobstructed view. No lights are used above the seats, except a small cluster to illuminate the registers. The remaining lights are placed underneath the car body, parallel to the running board. The registers are operated by bell cords running parallel to the footboard and with cords extending up to the side posts. Electric bells are also provided on each post, and there is also an electric bell for the conductor to signal the motorman, and one for the motorman to signal the conductor. The car makes two trips every evening and the distance covered is 20 miles. We are indebted to Mr. J. Boyle Price, of the St. Louis Transit Company, for the foregoing particulars and for our photograph.

New Range Finder.

At the meeting of the British Association for the Advancement of Science in Glasgow, Prof. George Forbes described a new folding range-finder for infantry. This device is of the type known as a "one-man portable-base range-finder" and is eminently accurate up to 3,000 yards. Although founded upon the Aidi instrument it possesses none of the disadvantages which characterized the latter apparatus. The British Navy is provided with the Barr and Stroud finders, which are stated to supply the requisite accuracy. A one-man instrument convenient in weight, shape and portability, has long been deemed necessary. It should be so accurate that at a range of 3,000 yards the possibility of error in the hands of a capable man should not exceed 2 per cent, and should be so simple and easy to comprehend that only a short training would be necessary to enable the manipulator to understand and to handle it capably. The Forbes range-finder is a small folding aluminium base 6 feet in length and a field glass. A square tube constitutes the base, with a hinge in the center, and at each end of the base there is a doubly reflecting prism. In use the rays of light reflected from a distant object strike the outer prisms, are then transmitted along the tube, and strike the center prisms, and are reflected into the two telescopes of the binocu-

lar attached to the base, in directions parallel to the rays which strike the outer prisms. By measuring the angle between these rays the distance of the object being surveyed is determined. The measurement of the angle is accomplished by means of two vertical wires, one of which is placed in each telescope and which are seen by the two eyes. One wire is fixed, but the other is rendered movable by a small micrometer screw. This latter is operated until the second wire merges, as it were, into the first, and the two appear as one. This has been ascertained to prove accuracy to 2 per cent at 3,000 yards. Prof. Forbes contended, however, that single coincidence was not so accurate as stereoscopic vision, since by the latter the wire appears to stand out in bold relief against the picture, and the slightest movement of the micrometer screw immediately shows whether the wire is near or farther away than the object being observed. Prof. Forbes' instrument complete weighs 4 pounds, the base weighing 3 pounds, and the binoculars 3 pounds. The latter apparatus has a magnifying power of 12 diameters.

Automobile News.

The boilers of steam motor carriages in Chicago must be inspected by the regular boiler inspection department of the city.

A service of motor-cars has commenced to run between Piccadilly Circus and Putney. The fare is eight cents, and the journey occupies half an hour.

A doctor with a strong penchant for the motor-car has written to the London Times suggesting motor-car driving, "fully up to the legal limit," as a means of administering the open-air treatment to consumptive patients. He says he has been much struck by the beneficial effects produced by a 30 to 50 mile motor-car drive. Along with a feeling of marked exhilaration, an increased appetite, and improved sleep, there is a heightened healthy glow which after a few days' treatment tends to become permanent. The tendency to cough is much diminished.

The Austrian Minister of Railways has ordered from the Vienna Daimler Motor Company a motor car for service upon the railroads. In reality it is a motor railroad car. It is of the same dimensions as the ordinary third-class European railroad carriage, with thirty-two seats and corridor extending through the center. Under the floor and attached to the foundation frame is the four-cylinder motor of 30 horse power, together with the usual mechanism and supplies. The car is to attain a speed of thirty miles per hour. Only one man will be necessary to drive it. Such independently-propelled cars in Austria are faster than the fastest trains.

Pasteur Institute Figures for 1900.

According to the figures which have been published for the year 1900, 1,420 persons have undergone the treatment for rabies at the Pasteur Institute. Of these 11 have died of the rabies. In the case of 6 of these latter, the death has occurred within 15 days after the end of the treatment, and one person was taken with the rabies in the course of the treatment. These seven cases will not be counted in the following table, as after experiments made with dogs, it is supposed that the nervous centers of the persons who have died within the 15 days have been invaded by the virus before the cure could be fully efficacious. The figures show, thus, 1,413 persons treated, 4 dead, giving a percentage of 0.28. In the last ten years the number of persons treated ranges from 1,800 to 1,400, and the number of deaths from 7 to 3. The persons treated at the Pasteur establishment are divided into three classes, as follows. A. The madness of the animal which had bitten the patient was proven experimentally by the development of the malady in animals bitten by him or inoculated with his virus. B. The madness of the animal had been shown by a veterinary examination. C. The animal is only suspected of rabies. M. Viala gives in the following table the distribution of the cases in these three classes, for the year 1900:

	Bitten on the Head.			On the Hands.			On the Members.			Total.		
	Treated.	Died.	Per cent.	Treated.	Died.	Per cent.	Treated.	Died.	Per cent.	Treated.	Died.	Per cent.
Case A.....	20	0	0	109	3	2 75	50	1	2.00	179	4	2 23
Case B.....	78	0	0	555	0	0	233	0	u	866	0	0
Case C.....	28	0	0	188	0	0	159	0	0	375	0	0
Total.....	126	0	0	852	3	0 35	442	1	0 22	1,420	4	0.28

From the point of view of nationality, the 1,420 persons treated are divided as follows: England, 14; Germany, 4; Belgium, 5; Denmark, 2; Spain, 2; Greece, 2; British Indies, 56; Switzerland, 1; France, 1,334.

Mr. Peter Nissen has successfully passed through the Whirlpool Rapids in his "Fool Killer II.," which we illustrated in the Scientific American for October 12, 1901.

Engineering Notes.

Iron ore is being shipped to the United States from Spain, and a vessel which carried a cargo of iron ore returned with a cargo of steel rails.

Flywheel accidents can be provided for by insurance policies covering all damages to persons and property caused by the breaking of the flywheels. The wheels are inspected before the policy is issued and at regular intervals thereafter.

A company is being formed at Amsterdam for working a coal deposit on the islands of Java and Borneo, says The Engineer. The greater portion of the coal obtained will be held at the disposal of ocean steamers.

According to German reports, the Greek government has just granted a concession to the British Eastern Railway Company for building a new railway between the harbor of Piræus and the Greek-Turkish frontier. This will connect all the Greek railroads with the so-called International Orient Roads, making communication with Greece less complicated than at present.

The British Naval Department has authorized the construction of a sixth submarine boat. It differs from the preceding vessels, which are of the Holland pattern, and also from the French type in many respects. It is not quite such a fast traveler as the French boats, but it will be able to rise and to descend with greater facility and celerity. A torpedo tube is placed at the extreme forward end of the boat, while four 18-inch Whitehead torpedoes are to be carried. The gear is also being arranged so that the torpedoes may be discharged while the boat is either stationary, running at any speed submerged, or awash. The boat is to be fitted with a horizontal rudder in addition to the vertical pattern. Automatic means also determine the angle of diving or ascending, and also prevent the possibility of descending to excessive depths. The men who have been selected for manning these submarine vessels are to receive double pay. The first boat, which is nearly ready, is to be attached to the first-class battleship "Formidable," for service in the Mediterranean.

The Egyptian government, which is about to place extensive orders for locomotives for its railway, has been carrying out some exacting tests with English and American locomotives manufactured by Messrs. Nelson Reid & Co. of Glasgow and Baldwin & Co. respectively. The trials were carried out on the simplest and fairest lines. The American engines were similar to the English type in every respect, with the exception of the boiler pressure, which was 160 pounds per square inch as compared with 140 pounds per square inch on the English engine. The total weight of the train hauled by the American engine was 443 tons, while that drawn by the English locomotive was 555 tons. The coal in each case was carefully weighed for the respective engines, at the starting point, but 6 hundredweight 98 pounds was allowed each engine for raising steam preparatory to the run. The trial trip extended from Gabbari to Cairo, a distance of 130 miles. When the engines arrived at Cairo the remaining coal was recorded and the consumption of the English engine was found to be 26 hundredweight. According to the official report of this competitive trial, the English engine is advocated as being much more economical in working and more efficient.

A bill for the purpose of reclaiming the Zuider Zee from the sea is to be brought before the Dutch government. The scheme is to inclose and subsequently to reclaim the vast semi-lake or sea which lies behind the Hook of Holland. To carry out the project a dam will first be constructed across the mouth from Wieringen in North Holland to Piaam in Friesland. This dam will be provided with a series of sluice gates, through which the water of the Zuider Zee will be pumped into the North Sea by means of powerful steam pumps. Work will then proceed on the southwest corner, and the remaining portion will be left as a fresh-water lake owing to the overflow of the River Yssel. There will be two sections of reclaimed areas. One will be the Wieringen area, 83½ miles in extent, containing 72 miles of fertile land; and the other will be the Hoorn area, with 121¼ square miles, of which 107 miles will be fertile land. It is computed that the completion of the work will occupy approximately eighteen years. The dam shutting out the North Sea would be finished in nine years, and the Wieringen section of reclaimed land would be ready for cultivation at the termination of fourteen years, while in the eighteenth year the Hoorn section would be completed. The cost of the undertaking will be about $39,000,000. A large number of villages mostly occupied by fishermen, will have to be swept away, and the compensation paid to the owners for this part of the work alone will amount to a large sum. As a means of compensating the fishermen it is suggested that the government should supply the fishermen with new boats and tackle, as their existing craft are not capable of fishing in the North Sea.

Electrical Notes.

Tests have recently been carried out upon three 220-volt, 200-watt Nernst lamps in Germany. The lives were severally recorded as 124, 293, and 369 hours. All three lamps were destroyed because the glower feeding wire melted close to the incandescent body. The voltage was continually 220 volts. The candle power dropped from 146 candles at the start to 99 after 100 hours, 81 after 220 hours, 60 after 300 hours, and 48 after 350 hours, the watts consumed per candle being 1.33, 1.91, 2.19, 2.68, and 2.89 respectively.

According to the eighth edition of the list of cables just published by the International Telegraphic Bureau of Bern, the Gummi Zeitung says, there exist 1,380 government-owned cables of a combined length of 39,851 kilometers, and 370 cables owned by private companies of a total length of 318,286 kilometers. The principal company, which disposes of 93 cables, of a total length of 73,223 kilometers, is the Eastern Telegraph Company of London. The longest cable is the one connecting Deolen, near Brest, with Cape Cod, Mass., laid down in 1898 by the Compagnie Française of Paris; it measures 5,878 kilometers.

A recent number of the Bulletin de la Société Internationale des Electriciens, says Insurance Engineering, contains a paper read before that society by Janet, in which he gives the results of a number of laboratory experiments made to determine the insulation resistance of various types of gloves worn by electric workmen when handling live wires. The experiments were performed with the gloves first dry, then wet, the testing voltage being 105 in each case. In the dry test the gloves were filled with mercury and suspended in a bath of mercury; in the wet test fine sand, dampened with acidulated water, was substituted for the mercury. The resistance in megohms ran from zero to 52,000 dry and from zero to 420 wet. On test by high-tension alternating currents three samples broke down at very low voltage, while three others broke down at 1,000, 2,000 and 11,000 respectively. The sentiment expressed in the discussion which followed the reading of the paper was, that insulating gloves cannot be generally relied upon as an effective protection, and that wiremen with gloves should not touch bare conductors, but only such parts as are already insulated.

The contracts for the conversion of the tramways of London to electric traction are exciting keen interest in the electrical world. They will be among some of the largest known, since the work will represent a total expenditure of approximately $15,000,000. The ordinary track and slot rails, fastenings, tie bars, are to be of English manufacture, but there is no such stipulation in connection with the electrical plant and the cross-overs, since it is thought that the British manufacturers cannot supply these special lines on equal terms with the German or American manufacturers. The conduit system has been selected, and it is estimated that the cost will be from $75,000 to $100,000 per double mile. Several difficulties will be encountered in laying the conduits, which will considerably retard the progress of construction, owing to the labyrinth of pipes a few inches below the surface of the street. It is doubtful whether any other city in the world possesses such an intricate underground network of pipes and cables as does the city of London. It is confidently expected, however, that the electric tramways will be open for traffic in January, 1903.

An electric railway is projected between London and Brighton, a fashionable resort on the south seacoast of England. Many business men in the city have their homes there, and it is anticipated that the new line will carry them to and fro much more quickly than existing facilities. The distance by the present railroad is approximately 60 miles and the journey is covered by express trains in about an hour. The new line, however, will be practically straight, measuring 46¾ miles—only a quarter of a mile in excess as the crow flies. It is proposed to run a half-hourly service of trains from both termini. The London terminus will be at Westminster in the West End. The train will be composed of four coaches of the American type and two Pullmans, for first-class passengers. The fare for the round trip will be $1.25 first-class, and 75 cents second-class; single trips to be half the round trip rates. There will only be three curves, but each of these will have a wide radius, so that they will not be felt. Power is to be derived from two generating stations, one at each end of the railroad, each developing 10,000 I. H. P., and each carriage will be equipped with its own motor, gathering the current by means of an electric brush running on a copper ribbon laid between the rails. One feature of the railroad is that it does not touch a single public building or church throughout its entire length. The shield tunnel will be requisitioned for boring the tunnels through the hills. The effect of this railroad will be to develop Brighton, which is already a large town, as a residential quarter for city men.

THE RUSSIAN BATTLESHIP "RETVIZAN."

The first-class Russian battleship "Retvizan" possesses special interest because of the fact that she is the first important foreign battleship to be constructed in an American shipyard. The first foreign orders for warships of the modern type were those given by the Japanese government to the Union Iron Works of San Francisco and the Cramp Shipbuilding Company of Philadelphia, for two high-speed cruisers. Both of these vessels have been built and delivered, and each of them considerably exceeded the contract speed. Following closely upon the trials of these vessels an order was placed by the Russian government at the Cramps' yard for the construction of a battleship and cruiser. The latter had her trials last year and achieved a speed of more than 23 knots an hour, thus taking rank as one of the very fastest vessels of her kind in the world. The battleship which forms the subject of our front page illustration has recently undergone her builders' trial, on which she attained an average speed on a 12 hours' trial of 18.8 knots per hour.

The "Retvizan," as she is called, is a first-class battleship of 12,700 tons displacement. In size and speed she may be compared with our own vessels of the "Maine" class, as is done in the table below:

	Maine.	Retvizan.
Length	388 feet.	374 feet.
Breadth	72 feet 2½ inches.	72 feet 2 inches.
Draft	22 feet 6 inches.	25 feet.
Displacement	12,300 tons.	12,700 tons.
Battery	4 12-inch.	4 12-inch.
	16 6-inch.	12 6-inch.
	6 3-inch.	20 3-inch.
	8 6-pounders.	20 3-pounders.
	10 small caliber.	6 1-pounders.

The "Retvizan" is protected by a belt of armor 9 inches in thickness which extends from 4 feet below the waterline to 3 feet above, reaching to the level of the protective deck. The latter is 2 inches in thickness on the flat and 4 inches on the slopes. It commences to slope at the level of the top of the 9-inch belt, and descends to a junction with the bottom of the belt below the waterline. The space between the slope and belt is occupied by coal bunkers. A projectile, before penetrating the engine or boiler rooms, would consequently have to penetrate 9 inches of Krupp steel, from 6 to 10 feet of coal and 4 inches of sloping Krupp armor. The coal would equal in resistance about 3 inches of vertical steel, and the 4-inch slope would be equivalent to 6 inches of steel, thus giving a total resistance equal to a vertical belt of 18 inches of steel, which is the thickness carried by our vessels of the "Oregon" class. In reality this triple protection would be equal to more than 18 inches of solid steel, for the reason that two successive face-hardened surfaces would have to be broken through, a test which would, unquestionably, break up any projectile that exists. The protective deck is carried the full length of the vessel, and curves down to meet the stem and stern. At the stem it is merged into the framing of the ram-bow, and being 3 inches in thickness and of turtle-back form, it gives enormous stiffness to the ram, and would assist in transmitting the shock of ramming to the whole structure of the vessel. Above the 9-inch belt amidships, and between the protective and the gun decks, is worked another belt of armor, 6 inches in thickness. This will prevent rapid-fire shells from penetrating and bursting beneath the guns on the gun-deck above.

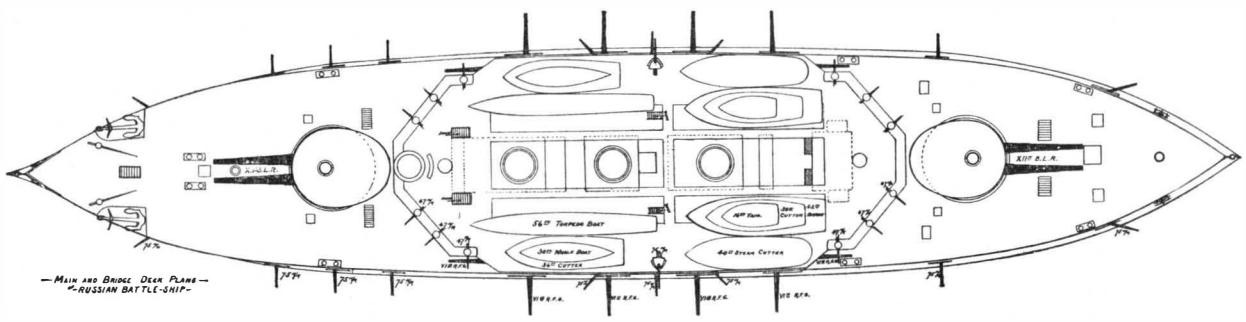
The bulk of the rapid-fire armament is carried on the gun-deck. Amidship, above the 6-inch belt of armor above referred to, is a battery of eight 6-inch rapid-fire guns in casemates, each gun having a considerable train forward and aft. The casemates are protected by 5 inches of steel and the armor is carried athwartships at each end of the battery as a safeguard against raking fire. The 9-inch and 6-inch belts of armor are also carried athwartships to connect with the armor of the barbettes, thus forming a completely inclosed armored citadel amidships. At the four corners of the superstructure deck, above the central citadel, are four 6-inch rapid-fire guns, of which the forward pair can be trained dead ahead and the other two dead astern. These guns are protected in front with 5 inches of steel, and they are inclosed in the rear with a wall of 2-inch steel, thus forming a completely inclosed casemate.

Forward of the central battery on the gun-deck are four 3-inch rapid-fire guns, each with a protection of 2 or 3 inches of casemate armor, while aft of the battery are six rapid-fire guns of the same caliber. The upper or main deck is flush throughout the ship, and is broken only by the amidship superstructure. Forward and aft of the superstructure are two elliptical balanced turrets, carrying 10 inches of Krupp steel. In each turret are placed two 12-inch, 40-caliber, breech-loading, rifles of the standard type manufactured by the Russian government. Both the turrets and the guns are operated electrically. An interior view of these turrets impresses one with the fact that the manipulating gear of both the guns and turrets is of a compact and serviceable design. There is an absence of complication and an abundance of working space for the gun-crew. The guns are mounted very close to the roof of the turret, according to the regular Russian practice, and the roof itself, which is of 3-inch Krupp steel, is slightly curved to clear the muzzles of the guns when the latter are elevated or depressed.

This battery, as it stands, is a numerous and powerful one, but the Russians, even more than ourselves, believe in a multiplication of guns, and outside of the twelve 6-inch and 3-inch rapid-firers, above mentioned, there are twenty-six smaller guns which are mounted on the boat-deck, the bridge and the fighting tops. Forward and aft on the boat-deck, there are distributed twelve 3-inch rapid-firers, while on the forward and after bridges, immediately above these, are eight others of the same caliber. These guns have a range of fire from dead-ahead to abeam. There are also six one-pounders in the two fighting tops. With such a numerous rapid-fire battery, a specially large supply of ammunition has to be carried, 2,400 rounds being supplied for the 6-inch guns alone. Three hundred and eight rounds are carried for the 12-inch guns, which is considerably above the number of rounds ordinarily carried in modern battleships for the main battery. Special provision is made for the supply of ammunition, electric hoists being installed throughout the ship.

The vessel is driven by triple-expansion engines, and steam is supplied by Niclausse water-tube boilers of a combined capacity of 16,000 horse power. The normal supply of coal is 1,016 tons, but it is possible to stow 2,000 tons aboard if so desired. As compared with our battleship "Maine," it will be seen that the main battery is not so powerful, our vessel, which is about the same displacement, carrying sixteen as against twelve 6-inch rapid fire guns. This, however, is somewhat offset by the larger number of 3-inch rapid-firers installed on the "Retvizan." The Russian government is so secretive in all matters affecting its naval department, that very little is known to the public about the present state of its ordnance. The guns, both 12-inch and 6-inch, appear to possess features in common with both the Canet and the Krupp types, although modifications have been introduced in accordance with Russian ideas. The 6-inch rapid-fire guns are of 45 calibers, or 5 calibers less than our new 6-inch guns. It is believed that the Russians, like the Germans, favor a heavier projectile and lower initial velocities than we do, having in view the consequent gain in remaining velocities, and greater penetrative ability at long range. Compared with our 6-inch naval gun, recently illustrated in the SCIENTIFIC AMERICAN, the Russian piece is considerably more complicated. The recoil and return to battery are controlled by a combination of glycerine cylinders and recoil springs. These springs, of which there are four, are located in the open on each side of the recoil cylinders, and certainly detract from the appearance of the piece, besides rendering it more liable to disablement by flying fragments of shell. The breech mechanism, moreover, is considerably more complicated than the modified Welin breech mechanism which was recently adopted by our navy.

The "Retvizan," taken altogether, is unquestionably an exceedingly fine representative of the up-to-date, first-class battleship. She has high speed, large fuel capacity (for it should be mentioned that her double bottom is to be utilized for carrying a certain amount of liquid fuel); the battery is numerous and thoroughly modern; while the ship itself has a high freeboard, and is remarkably free from those towering superstructures which disfigure many modern battleships, especially in the French navy. On going through the vessel we were impressed with the fact that inflammable material was practically non-existent. The decks are of steel and the partitions are of the same material, as are the shelves, boxes and general furniture. The Messrs. Cramp are to be congratulated on having turned out such a thoroughly handsome and effective vessel.



DECK PLAN OF RUSSIAN BATTLESHIP.

Emery-Coated Tools.

The use of emery tools has been limited because the material does not lend itself readily to shaping; we are practically confined to grinding surfaces of simple forms, says The Engineer. The galvanic process invented by Joseph Rieder, of Leipzig, however, allows us to make use of any kind of emery powder, and to arrange it in various shapes, so that we are presented with a new style of emery tool. Rieder is known as the inventor of the electro-engraving process, whose characteristic feature is a machine which returns the plaster negative to its position with mathematical accuracy, so that the galvanic etching, which has to be interrupted several times a minute to secure uniform electrolytic action, practically remains continuous. In order to fix the emery sand on the tools referred to above, he first coats the emery with a varnish obtained by dissolving wax or paraffin in benzin. Graphite will adhere to the grains when they have been treated thus, and in this way the emery surface is made electrically conductive. The tool, e. g., a disk, is placed in the sulphate of copper bath, and the prepared sand dropped on it. Each grain will become embedded in a coating of copper, and the grains will thus be fixed just as gems have been mounted for some time by means of a galvanoplastic process. The sand can also be treated with a glycerine paste, which is then applied to the surface to be covered with emery. As soon as a thin film of copper has settled on the steel, the glycerine is washed off with hot water, and the copper film is afterward thickened in the bath. In this way emery tools are obtained, which are said to wear very well. Their disadvantage is that they do not cut deeply, because the interstices are filled up. But such disks can be revolved at a much higher rate than we could venture to adopt in the case of an ordinary emery wheel of the same dimensions. Another advantage is that we can construct tools of this kind in almost any shape—hollow drums, cutters of various profiles, reamers, convex or concave lenses, knives, engraving tools, and even files. When the electrolytic file-sharpening process came up about ten years ago, the invention was ascribed to and claimed by several inventors. In that case the file is the anode. Here we have a cathodic process which may also have occurred to several scientists, though we are not aware that anybody but Rieder has put emery-coated tools on the market.

Agriculture Along the Yukon.

The outlook for gardening and some agriculture in the cold interior region of Alaska, along the Yukon, is made quite encouraging by official reports recently received at the United States Department of Agriculture at Washington. Prof. C. C. Georgeson, who is in charge of the Alaska experiment stations, has spent the summer in the interior and along the Yukon Valley, visiting the experiment station established by the Department of Agriculture last year at Rampart, just outside the Arctic Circle, and other points where experiments were arranged for. Good gardens were found all along the route, especially at Eagle City and Holy Cross Mission. Although the season was unusually late this year, new potatoes, cabbage, cauliflower, beets, and other vegetables were ready for the table before the middle of August, and lettuce, radishes, and turnips grown in the open had been in use for some weeks. Flower gardens containing a large variety of annuals grown from seed furnished last year were in full bloom. At the station at Rampart, rye, seeded the previous fall, wintered perfectly and was ripe in July. Spring-seeded barley had ripened about the middle of August, and there was quite a prospect for oats and wheat to mature.

Extensive areas of excellent land were found on the Lower Yukon upon which there was an abundant and often luxuriant growth of grasses over six feet in height. The abundant moisture and long days during the summer months account for the surprising luxuriance of vegetation in that far-north region.

One of Prof. Georgeson's assistants will make a trip overland from the Yukon Valley to Prince William Sound, taking the trail from Eagle City. This will afford opportunity for a reconnoissance of that region, which is reported to contain large tracts of land well suited to agriculture. A report of this trip and of the season's operations of the Alaska stations as a whole will be submitted to Congress in the early winter.

FRENCH MILITARY FOLDING BICYCLE.

Both the bicycle and automobile are meeting with favor from the army authorities in Europe. The bicycle has ceased to be considered purely as a means of locomotion for pleasure, and is now regarded as an efficient mount for soldiers. For scouting and the conveyance of dispatches, the bicycle is without a rival, being noiseless, occupying small space and affording a very insignificant target to the rifle fire of the foe. It is reliable, and a bicycle company or division is very mobile. The wheel also affords the enormous advantage over the horse in that it requires no forage supplies.

At the recent maneuvers of the French army the bicycle demonstrated its great value. The wheel which we illustrate was invented by Capt. Gerard, of the French army, and can be folded up and carried on the back. The frame is strengthened by a second tube running parallel with the first, thus giving the machine great rigidity. These two tubes, owing to their considerable diameter, reduce the vibration that plays so great a part in the expenditure of energy by the bicyclist. At the center of the right-hand side of the parallelogram forming the frame, there is a ball joint. Each of the parallel tubes is divided in the center, and the ends, which are beveled, are held in place, when the machine is opened, by coupling sockets. When the ends of the tubes are exposed by loosening the sockets and shoving them back upon the rings, the front part of the bicycle can be folded around onto the rear half, the wheels being superimposed. If desired, the bicycle may be divided into two parts, while the handle bar can be removed from the steering head. A novel form of brake is also provided. The wheel is of such a height that the bicyclist can maintain such a position in the saddle that he can at any moment touch the ground with his feet.

FRENCH MILITARY FOLDING BICYCLE.

OILED ROADBEDS.

BY WALDON FAWCETT.

The plan of making roads dustless by incorporating crude oil into the dust of an ordinary earth road for the purpose of holding the dust down and securing a permanent roadbed has been introduced successfully on highways in various parts of the country, particularly in California, and the same scheme is now being utilized to secure dustless roadbeds on several of the principal railroads of the country. In the case of these steam roads, the officials in most instances made a trial of the dustless process purely as an experiment, and were, at the outset, far from sanguine of success; but the system has proved so satisfactory that it is being rapidly extended, and at the present time there is an aggregate of over one thousand miles of oiled roadbed on the various railroad lines of the United States.

For the operation of oiling a roadbed the sprinkling machinery is attached to an ordinary flat car, and the regular railroad employés are capable with a little instruction of manipulating it satisfactorily. The oil-sprinkling car proper is simply for carrying and manipulating the sprinkler, the oil being stored in ordinary commercial tank cars. Extending the length of the car is a four-inch pipe with provision at either end for making connection by means of rubber hose with the oil supply. The main pipe is connected near the middle of the car with a branch pipe, which in turn carries the oil to three sections of two-inch pipe, which constitute the sprinkling device.

One of the two-inch pipes mentioned is suspended transversely below the car and extends the full length of the cross-ties. Swinging from either side of the car is one of the other sections of two-inch pipe, and when in extended position, they reach out on either side over the slight embankment on which a railroad roadbed is usually placed; whereas when the car is in a cut they reach up the slope on either side to a height of two or three feet. The oil escapes through slits, each about three inches in length by one inch wide, cut in the under sides of the three pipes comprising the sprinkling mechanism.

The side arms of the sprinkler are each supported at the outer end by a chain controlled by a hand wheel, so that they can be readily raised or lowered to conform to the character of the roadbed. Moreover, each side sprinkler is yieldingly held, so that no serious damage is likely to result should it strike an obstruction. To control the flow of oil from each pipe there is provided a two-inch, quick-acting gate valve, worked by a lever, and these are supplemented by globe valves fitted to the main supply pipe at either end of the car, to which there may be attached, should it be found desirable, lengths of rubber hose fitted with hand sprayers. The latter are frequently of service in sprinkling portions of the roadbed beyond the reach of the fixed pipes, and can of course be utilized in the event of the temporary derangement of any of the regular apparatus.

For oiling a roadbed a train is made up of a locomotive, one of possibly two tank cars for carrying the supply of oil, and the sprinkling car proper. With so light a train it is possible for the locomotive to also supply steam or compressed air to aid in ejecting the oil, although this is very seldom necessary. The oiling train usually proceeds at a speed of about four miles an hour, and an average of two thousand gallons of oil a mile is used.

For sprinkling purposes there is now manufactured a special, non-inflammable, and practically odorless oil, which is of an exceedingly high fire test and low gravity, thus virtually eliminating all danger of combustion. Some odor is noticeable after application; but this disappears within a few days. When a stretch of roadbed is oiled for the first time the expense entailed for oil ranges from $32 to $45 a mile, according to the distance the oil must be transported; but subsequent sprinklings do not need to be so thorough, and the annual expense for oil seldom exceeds $16. Of course it is highly essential that no oil come in contact with the rails, and to preclude the possibility of this, shields almost two feet in length are fitted on the sprinkling car above each rail.

The main advantages claimed for oiled roadbeds are found in the reduced expense of track maintenance and the preservation of ballast. The oil destroys all grass, weeds, and vegetation in the ballast; forms a waterproof covering or soft crust, which prevents water from penetrating below the surface, and consequently prevents the loss of ballast by abrasion from rains and floods; prevents frost in the ballast with the consequent "heaving" of the track, and by providing a water-repelling coating preserves the cross-ties. The reduction of

VIEW OF COMPLETE OIL-SPRINKLING TRAIN, SHOWING SIDE SPRINKLER IN ACTION.

BEFORE OILING, SHOWING DUST RAISED BY EXPRESS TRAIN.

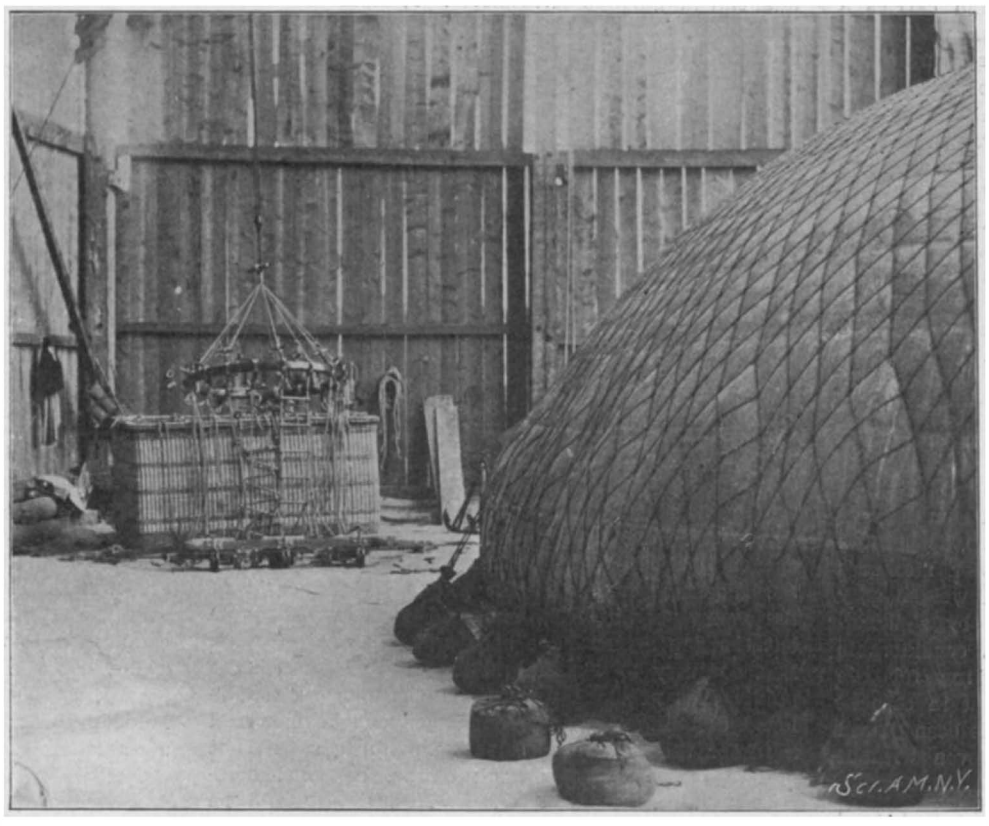
AFTER OILING, SPEED OF TRAIN 60 MILES PER HOUR.

wear on the machinery, a partial elimination of hot boxes, and the saving of the furnishings of cars are incidental qualifications claimed for the new plan.

The most ingenious recent use of oil on highways is its employment to render certain roads in the vicinity of Redlands, California, adapted to the use of automobiles. Under normal conditions the roads in Southern California are not at all suited to the use of horseless vehicles; but so successful has been the oil treatment inaugurated in the vicinity of Redlands, with special reference to the requirements of the motor vehicles, that automobiles have of late become quite common in that section of the State.

In order to enable a comparison between the expense of sprinkling the roadbed of a steam road and that entailed for similar service on ordinary thoroughfares, it may be noted that in California, where the idea of using crude petroleum residuum on roads originated, a contract was some time ago entered into, whereby an incorporated company agreed to care for an immense mileage of roads, putting on three applications of oil during the season, and keeping the roads free from dust from May 1 to December 1 for $204 a mile. In some parts of the Golden Gate State, where oil is not merely used instead of water to keep the dust down, as is the plan of the contracting company above mentioned, but is employed also as an important element in making a permanent roadbed, the oil is poured on at the rate of 150 barrels to a mile, and not infrequently the quantity is in excess of this amount.

In order to make the oil thin and active in movement, it is customary in California to apply the oil hot, the temperature ranging from 200 deg. up. In some instances the oil is obtained directly from the refineries at a temperature ranging from 250 to 300 deg.; while in isolated localities heating plants have been installed, usually consisting of steam coils running through the storage tanks at the supply station. The oil wagons or hauling tanks, each holding about 20 barrels, or 840 gallons, are jacketed to retain the heat. Oil has in some instances retained sufficient heat to be of service at a distance of twelve miles from the heating tank; but as a rule no attempt is made to transfer the heated oil more than six or eight miles.



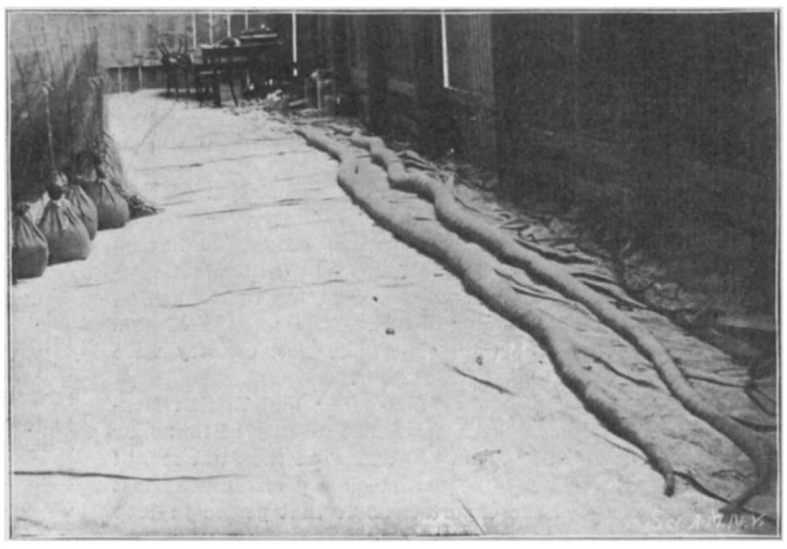
THE BALLOON PARTIALLY INFLATED AND THE BASKET.

COUNT DE LA VAULX'S BALLOON TRIP ACROSS THE MEDITERRANEAN.

BY OUR PARIS CORRESPONDENT.

Count Henri de la Vaulx has attempted to make a balloon trip across the Mediterranean from Toulon to Algeria. A balloon shed was erected on the beach near Toulon, and the trip began October 13.

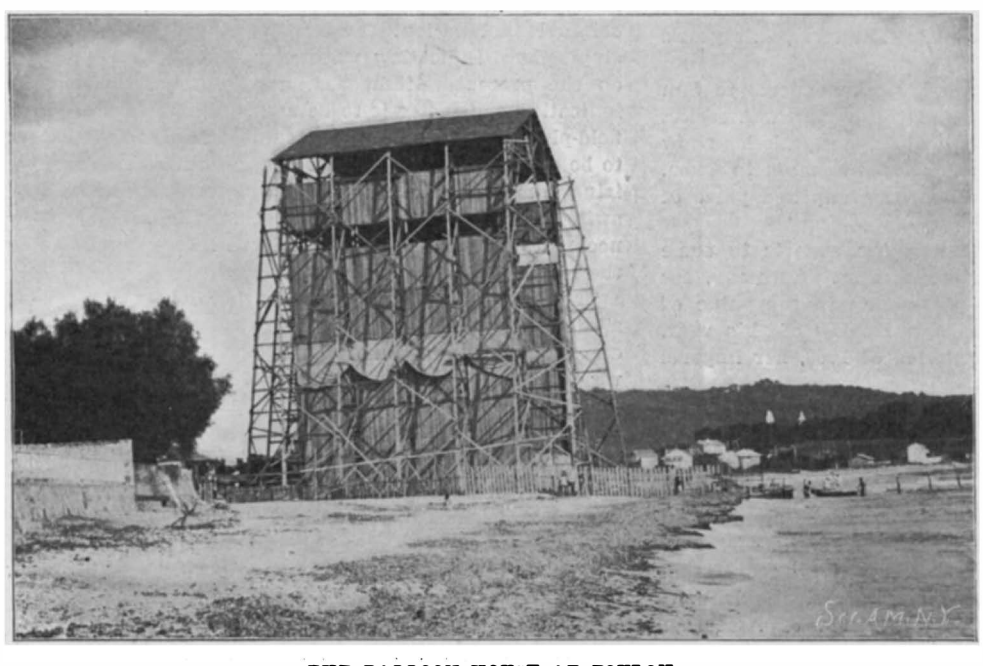
M. Hervé has been working on the problem of steering balloons upon the sea for a number of years. His first experiments were made with the "National," a balloon of 1,500 cubic yards, in 1886, in which he crossed the Channel from Boulogne-sur-Mer to Yarmouth, over a traject of 240 miles. In these experiments he used two flexible floats made of cordage and covered with canvas, of serpentine form, which were suspended by ropes one on each side of the car and followed the undulations of the waves. The height of the balloon was regulated by drawing them more or less out of the water, and he could thus keep the balloon at the desired distance above the sea. The steering device consisted of a kind of floating rudder attached to the balloon by a long rope, and by varying its angle the balloon could be steered to 60 degrees on each side of the wind. These experiments were quite successful, and M. Hervé was able to deflect his balloon toward the west and land at Yarmouth, while the wind was blowing north, and made without accident the long voyage of 24½ hours over the sea. This duration was only surpassed 14 years after by M. Castillon de St. Victor and M. Mallet. In the present trip M. Hervé used the old "serpents" with a third floater made of wood. The serpents are each 30 feet long and 7 inches in diameter at the middle, made of cordage covered with canvas, the whole well water-proofed; each weighs 180 pounds. The wood floater made for this occasion is about 16 feet long and 12 by 18 inches' section, and weighs 1,300 pounds. It is made up of fifteen pieces jointed together so as to give a great flexibility. Like the serpents, it floats on the water and may be wholly or partially raised by a rope. In the recent trip the ropes of the two serpents were attached to the ends of a support above the car, and the large float was hung from the middle.



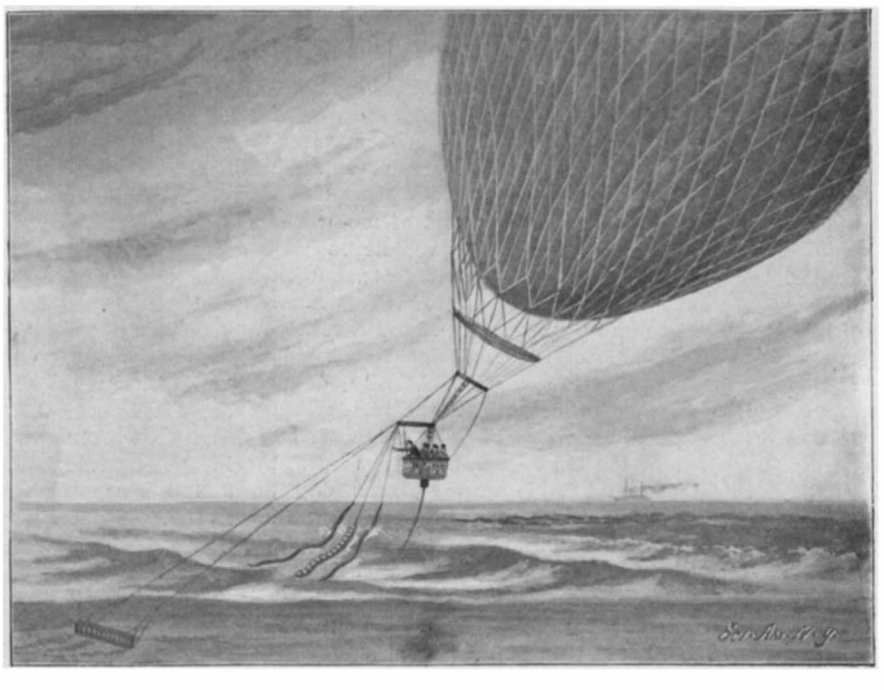
THE "SERPENTS" USED IN STEERING.

The steering device is essentially a kind of floating rudder whose position may be varied from the balloon. Two of these "deviators" will be used, but only one at a time, according to the conditions of the weather. The first of these is of the same type as in the Boulogne-Yarmouth experiment. It consists of a series of concave blades about 2½ feet long and 8 inches wide, held parallel to each other by iron straps. The deviator is attached to the balloon by two ropes, and remains in a nearly horizontal position. When the ropes are of the same length the blades are perpendicular to the direction of the balloon and there is no deviation, but only a certain resistance; but if one of the ropes is shortened the blades take an oblique position and the apparatus diverges rapidly to the right or left, drawing the balloon with it. It possesses an enormous power, owing to the large surface and the concavity of the blades. The whole is arranged so as to fold into a small space when not in use. With this form of deviator it is necessary, in order to change from one direction to the other, to pass through the perpendicular position, or point of maximum resistance. In the case of a strong wind may not be advisable to do this, and a second form has been devised which offers less resistance and is more easily managed. It consists, as the figure shows, of a set of parallel blades joined together to form a solid box or frame, and the blades take a vertical position in the water. A strap at each end carries a rope passing to the balloon. When the ropes are of unequal length the deviator takes an oblique position and gives a steering effect; when the ropes are equal the blades become parallel to the direction of movement and there is no deviation and but little resistance. This instrument is, in fact, a multiple rudder of the simplest form. Both these deviators have been designed to keep at a certain depth below the surface of the water by giving a certain inclination to the curved blades or to the box so as to give a downward pull which compensates for the upward pull of the rope, and this is the same at all speeds, according to the well-known laws of resistance.

The balloon, called the "Méditerranéen," was constructed for the experiment by M. Mallet, and has a diameter of 56 feet and a capacity of 3,800 cubic yards. It was filled on the spot by a hydrogen generator.



THE BALLOON HOUSE AT TOULON.



THE BALLOON ON THE BAY OF BISCAY.

The balloon will raise about 7,500 pounds total weight. The suspension of the car has been designed so as to support the floats and steering apparatus. The ropes of the balloon are attached to a horizontal cross-bar, and from this swings the car in one plane. To the cross-bar is attached a wood framework which projects out horizontally on one side and carries a set of pulleys for the maneuvers, over which the ropes pass down into the car. The two serpents hang down from the ends of the frame and the wood floater hangs from the middle. This arrangement will be seen in the figure. A novel feature is the arrangement for using water as ballast. At each side of the frame is suspended a light brass cylinder, which has a tube passing above and another which hangs down into the water. When the air is exhausted by a small pump the water rises in the cylinder. The lower tube may be drawn up by a rope and the cylinder is thus emptied at will and the height of the water is always known. The cylinders are about 4 feet long and 20 inches in diameter, and each contains 40 gallons. The car of the balloon, shown in the engraving, has been designed to give great rigidity and also to accommodate all the different appliances; a set of horizontal projections pass all around the inside and afford a brace as well as a set of shelves. The middle or "deck" of the car is thus left entirely free, as is quite necessary for these maneuvers. The car measures about 6 by 8 feet and 4 feet deep, and weighs only 450 pounds. It is entirely surrounded by a waterproof canvas which is brought up to a considerable height above it, leaving only an opening for the maneuvers. This renders it floatable, but in case of emergency a set of life-preserver bags has been placed all around the inside and it will float even without the canvas.

There were four aeronauts in all, and two were occupied with the maneuvers while the other two slept upon a circular platform of canvas which is stretched across below the balloon. It is intended to keep the balloon about 25 or 30 feet above the sea. It was kept swelled out into spherical shape by an air-bag in the interior which is filled by a horizontal air-fan worked from the car. The balloon carried a number of instruments, some of which are of a novel type, as well as a powerful projector, fed by a primary battery, to light up the apparatus in the sea, also a large signal light and the usual marine signal lamps. A novel feature is the use of acetylene buoys, conical vessels of sheet iron containing carbide of calcium, which when thrown into the sea give a brilliant light and indicate the passage of the balloon as well as afford points of alinement for the route.

The party started from Toulon at 11:30 P. M., October 12, followed by the cruiser "Du Chayla," and carrier pigeons were received a few hours later stating that the balloon was driven by a north-northeastern wind and was traveling at a high speed, the weather being fine and all were well. Unfortunately the enterprise was not to be crowned with success, for on October 15 the cruiser was sighted returning with the balloon and her passengers which she picked up ten miles east of the St. Laurent lighthouse. When Count de la Vaulx landed he stated that the weather had been very bad on the preceding day. A hard east wind drove the balloon toward the coast of Spain and a heavy rain also fell. The balloon had almost reached the Spanish frontier, the St. Laurent light being a small port in the Department of the Eastern Pyrenees. The passengers in the balloon feared that they would be blown ashore, so they decided to abandon the voyage and signaled the cruiser to take them on board. This was done with only slight damage to the balloon and with no injury to the passengers or scientific instruments. The voyage lasted forty-two hours.

A Bank on Wheels.

One of the most brilliant ideas of modern times has just occurred to the local authorities who administer the public moneys of the town of Mezieres, in the Ardennes. The new scheme consists in an "automobile savings bank." The term requires some explanation.

The inventors apply it to a new sort of motor car which they are having built. The vehicle is propelled by electricity and contains four seats, one in front and apart from the others, for the driver. The three places behind are arranged round a revolving table in the middle of the car, one at each side and one at the rear of the vehicle. Writing desks are fitted over each of the three seats and devised in such a way that they can be either folded flat against the sides of the carriage inwardly or opened outwardly. The central table also contains desks, besides book shelves and a small metallic strong box. Such is the new automobile. The use to which the authorities of Mezieres intend to put their invention is as follows:

The car will travel round the country, making stoppages of an hour or so on prearranged days in the different localities of the department. The passengers will be two clerks of the local treasury administration and a cashier. They will carry with them a complete collection of savings bank books, registers and forms, and the third of the above mentioned officials will be empowered to receive moneys. Our readers will have now divined the purpose of the financial authorities of Mezieres. It seems that these gentlemen, assembled in council lately, came to the conclusion that something should be done to encourage thrift among the peasantry of the Ardennes. On the other hand, it was recognized that the saving propensity was already very marked among the country folk. What was needed was that the administration should meet their wants half way. The peasants put by their earnings thriftily enough, but frequently fail to invest them in savings banks because, especially in the busy summer months, they have little time for journeying to the few principal towns where the offices are situated. So the authorities determined upon sending the savings bank to the country folk instead of waiting any longer for the latter to find time to come to the office.

The description of the vehicle which the authorities have had built, according to their own designs, requires no further explanation except to say that the movable desks are intended for use by the public, hence the arrangement by which they can be opened outward over the road. It is reported that the scheme meets with the unqualified approval of the savings bank clerks, whose days hitherto throughout the fine season have been spent in musty offices. But, contrary to what might have been expected, the public does not look upon the innovation with unalloyed delight. Some suspicious persons have spread a rumor that the administrative motor car will not always convey savings bank clerks, but will occasionally bring—more often, perhaps, than would be desirable—that unwelcome visitor, the tax collector.

Increased Cycle Exports.

In view of the steady annual decrease in the exportation of American bicycles from 1897 to 1900, inclusive, recent statistics, indicating a stronger demand abroad for them, are interesting.

The latest official statement on the subject, prepared by the Treasury Department at Washington, gives the amount of the cycle exports up to August 1, 1901. In July the value of wheels shipped to the United Kingdom was $37,140, as against $25,396 in July, 1900. For seven months ending with July, 1901, the total of the cycle exports to that country was $354,196, as compared with $348,223 during a similar period last year.

For the one month named, the exportation of bicycles to France was even more satisfactory than that to England, wheels to the value of $23,030 having been shipped there during July, 1901, as against shipments amounting to only $7,202 in the corresponding month of 1900. For the first seven months of this year, though, the total exports to that country were slightly less than those of 1900.

Cycle exports to Central America and British Honduras have never been large, but in July of this year they exceeded, by about $300, those of the same month last year, and for the period ending on July 31 last they exceeded the exportations of that period in 1900 by nearly $3,000.

A striking increase is noticeable in the shipments to China. In July, 1901, the wheels sent to that country were worth $28,849, whereas, in July, 1900, cycle exports amounted to only $1,914; and in the first seven months of this year the shipments to China represented a value of $41,991, as against $16,294 in 1900.

Although the cycle exports to Africa in July of this year were somewhat less than those of the same month in 1900, the total value of the shipments for the seven months exceeded by almost $20,000 the value of last year's exports for that term, this year's figures being $46,780.

Increases are also recorded in the exports to San Domingo, British Australia, British North America, and the British East Indies, while the statistics show little change in the value of the shipments to Cuba, other islands of the West Indian group and parts of Asia and Oceanica.

It is true that the value of the exports to some other countries continues to decrease. Germany, for example, imported American wheels to the value of $160,866 during the first seven months of this year, whereas, during the same period of 1900, her imports amounted to $303,715.

In South America, also, the sales of wheels made in the United States are not what they should be, and this is conspicuously the case in Argentina and Brazil. In these two countries, as in other parts of South America, bicycles of German make appear just now to be the most popular; but this state of things is due, for the most part, to the activity manifested there by the German cycle agents and the lack of push exhibited by the representatives of American manufacturers.

Taking it all in all, however, Uncle Sam's wheels, in spite of the lively competition in the cycle industry all over the world, are holding their own.

The Snoqualmie Falls Power Plant.

To the cities of Seattle and Tacoma will be carried 20,000 horse power instead of the 8,000 now in use at these places. This will be brought about by the enlargement to double its present capacity of the plant now deriving its power from the Snoqualmie Falls.

Of all power plants in existence, this hydro-electric installation is probably the most interesting. In the last six months it has been visited by engineers from all over the world who testify with high praise to its correct design and the superior excellence of its mechanical operation. With a most varied service that includes electric traction, mill and factory power, as well as ordinary illumination, the entire load of the Snoqualmie system is operated in multiple, and with a regulation of less than 2 per cent.

Two years have passed since the first current from Snoqualmie Falls was carried into Seattle and Tacoma, and in this short time the initial installation has proven too small. The capacity of the plant is to be enlarged to meet the increasing demand for power in these cities. At the Falls, distant 44 miles from Tacoma and 32 miles from Seattle as the crow flies, are installed in a rock-excavated chamber four generating units, each consisting of a water wheel direct-connecting to a 2,000-horse power three-phase alternator. At the same transmission voltage now employed, 30,000 volts, it is proposed to carry 12,000 horse power more into the cities mentioned, making a total output of 20,000 electrical horse power.

The water wheel contract will not be let for 60 days. If an impact wheel is used, there will be a single wheel on each end of each generator shaft, and each wheel will be driven by a single jet of water 14 inches in diameter, the two jets combined being sufficient, under the existing head of 270 feet, to give the requisite power. The two water wheels and the generator between will be built on a single hollow shaft of oil-tempered nickel steel.

The present underground generating station, which is 200 feet long, is to be lengthened out 150 feet up stream to make room for the new installation. A new penstock is to be built which will carry 50 per cent more water than the old one. The transmission that is to parallel the old line will require 125 tons of aluminium wire, and the order for it has already been placed. At Tacoma, a large and commodious brick sandstone sub-station is now being erected. The entire cost of these improvements will be in the neighborhood of $400,000. The work is to be vigorously prosecuted, and it is expected that the first of the new generators will be delivering current into Seattle and Tacoma within the next nine months.

The generating machinery will consist of three 3,000 kilowatt, 4,000 horse power, rotating-field generators of the two-bearing type, generating a three-phase current at 1,100 volts and 7,200 alternations. The speed is to be 100 revolutions per minute. Each generator will require an exciting current of 320 amperes approximately, at 125 volts. For exciting these three generators a 200 kilowatt, eight-pole, direct-current generator of the two-bearing type is to be used. At 175 revolutions per minute it is to deliver under normal load a current of 1,600 amperes at 125 volts.

The current which is generated at 1,100 volts is to be raised to a line potential of 30,000 volts by nine 1,000 kilowatt, oil-insulated, water-cooled transformers. These are to be delta-connected on both the primary and secondary sides. It is estimated that each transformer will weigh 11,000 pounds, and require 500 gallons of oil. The switchboard that is to be installed is to consist of 14 panels of white marble, and is to be of the special type that was furnished for the original installation. Instead of the Niagara type single-phase indicating wattmeter that is now in use on the present switchboard, a poly-phase, long-scale indicating wattmeter is to be used. Where formerly a field-plug switch was used a double-pole field switch is to be employed. The standard equipment of synchronizing lamps is to be replaced by a single-pole plug switch, mounted on the generating panel and connected to a synchroscope, which will be mounted on the multiplying panel.

The increased capacity of the generators will necessitate placing three single-pole main switches, instead of one three-pole main switch. The circuit breakers, which are to be non-automatic, will be on an extension panel above the main instrument panel. A. W. C.

Another Antarctic expedition is being organized in Scotland. The fund for the cost of equipping the vessel has been started by a donation of $25,000. Capt. Bruce, who has had much valuable experience in connection with both Arctic and Antarctic exploration, will command the expedition. It is anticipated that a start will be made in the autumn of next year.

SOMETHING ABOUT ANCIENT AMERICAN SAURIANS.

BY J. CARTER BEARD.

The vast region known as the Western Plains, so interesting to visitors, not more on account of the unparalleled magnificence of the scenery than of the curious and wonderful development of its geological features, including, as it does, the tremendous cañons of Colorado, the lava fields of Dakota, the strange painted cliffs of the National Park and the extraordinary geyser region of Wyoming, is the paradise of the paleontologist, for here lived and died the uncounted generations of reptiles that peopled the ancient earth and the waters of North America during the Mesozoic era. But, while all this region affords fruitful fields to the fossil hunter, Kansas has proved the most prolific tract for those who, like Prof. S. W. Williston, have made something of a specialty of ancient American sea saurians.

Of the twenty-five or thirty species which, as yet, have been found distinctive among all the specimens collected, Dakota has contributed three, Mississippi, Alabama, Carolina and New Jersey, together, about ten, and Kansas twelve.

Although expeditions, extending from 1854 up to the present time, have been engaged in collecting fossil remains in the territory described the supply is still unexhausted, and is considered by those who have, perhaps, the best information to be procured on the subject, inexhaustible. In this they may be mistaken, but it cannot be denied that though the number of tons of material of this kind which has been received by our museums and colleges is not easy to estimate exactly, and though room can with difficulty be found for what is already possessed, the cry is still it comes.

Indeed, considering the perishable nature of osseous substance it is really wonderful that anything at all, except perhaps the impressions of parts of animals or their foot-prints in damp soils, that have hardened into rock should remain to us of vertebrates which lived upon the earth at such very remote periods of time.

The structure of bone is such that, under ordinary circumstances, more or less rapid decay must necessarily ensue upon its exposure to atmospheric and aqueous agencies. The hardest bone is traversed with what are called Haversian canals, winding passages which are connected by still smaller passages with lacunæ, and the less solid takes the form of cellulated substance permeated with sarcodic matter, while the long bones are generally hollow and contain marrow, whose corruption and decay, together with that of all the soft tissues occupying bone cavities, infects the ossein, and by breaking away the delicate partitions between tubuli, and by softening all adjacent parts, hastens its disintegration. The labyrinthine system of passages which pervades the whole bony structure, enlarged and emptied of the soft organic matter that occupied it, readily admits water and becomes filled with it. This not only carries vegetable acids that tend to decompose the bone, but in freezing expands and pulverizes it as effectually as if it had been pounded to pieces with a hammer.

Quite as surely subject to destruction are the bones of animals deposited on beds of seas or oceans. Sea water is a slow but almost universal solvent. The dredges of the United States fish commission steamer "Albatross" and of the "Fish Hawk," as well as those of the numerous other vessels which have from time to time explored the bottom of the ocean, have been dragged many miles without bringing to light any other remains of vertebrate animals than a few shark's teeth.

It may, therefore, be readily seen what a very small proportion as compared with the original supply of these bones can have escaped destruction in undergoing the vicissitudes of such an enormous length of time, and from this may be argued the populousness of the Western plains during past geological ages.

The gradual development of new species and genera, and the increase of the numbers of individuals composing them, of the saurians of the Mesozoic era, in the æons preceding the attainment of the highest point in the scale of physical organization reached by reptiles during the Jura Trias period, was indeed, it is believed, so great and extensive that the land areas inhabited by them became overcrowded. It was then that animals best adapted in form and by habits of life to do so began to look to the water for food and, in time of danger, for refuge. In this way the sea, previously monopolized by ammonites, sharks and cuttlefish, became the home of reptiles.

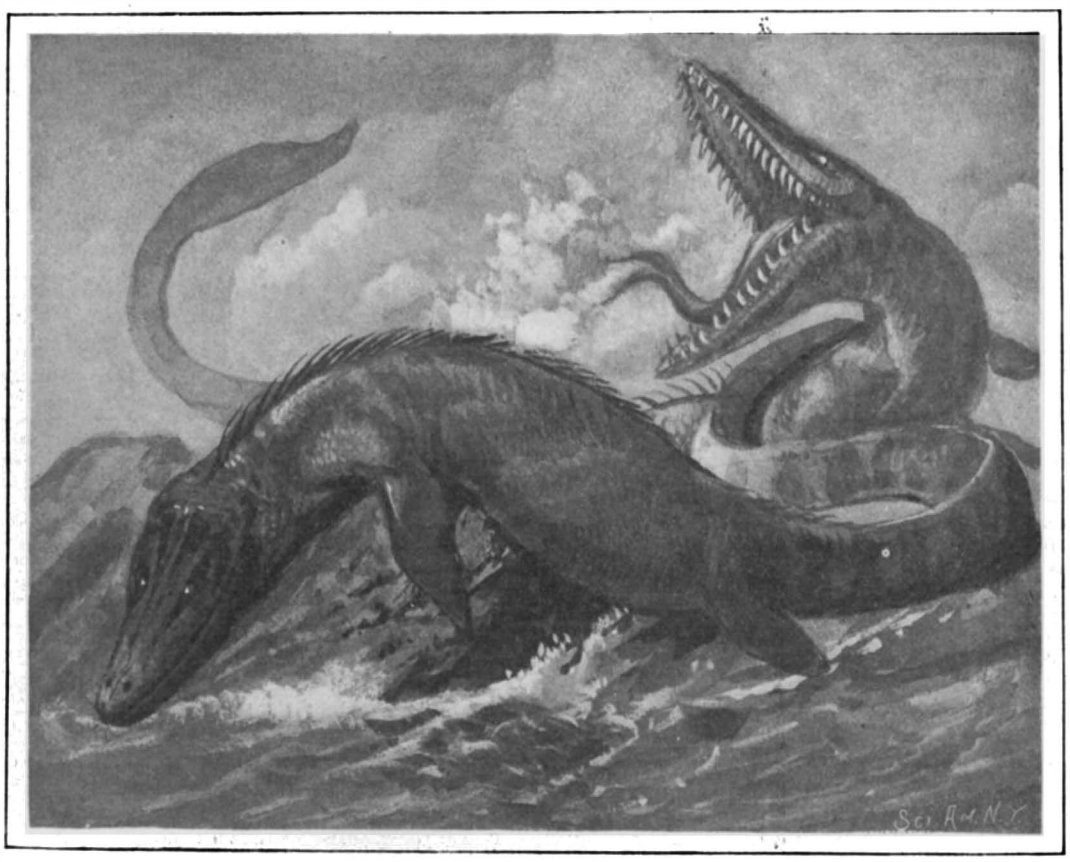
It is well known that by some little known law of nature, certain species of fish, carp for instance, are able to accommodate their growth to the size of the area of water accorded them to swim in, and it seems necessary to conjecture a freer and more extensive working of some such law to account for a process of development by virtue of which insignificant little land lizards, such as the nothosaurus and the Isodectes punctulatus, were able to take upon themselves the colossal proportions and transform their digital limbs into the paddles of the elasmosaurs, plesiosaurs and mososaurs, and the ichthyosaurs, whose remains are so characteristic of the cretaceous fossil beds of Europe and America.

WHAT THE ANCIENT AMERICAN SEA SAURIANS LOOKED LIKE.

The elasmosaurs more nearly resembled a snake bird (ahinga) in form than they did any other creature now living.

They were found 30 to 60 feet in length. Prof. Edward Drinker Cope, the celebrated paleontologist, has furnished a very graphic description of the elasmosaurs:

"Far out on the expanse of the ancient sea," writes the professor, "might have been seen a huge snake-like form which rose above the surface and stood erect with tapering throat and arrow-shaped head, or swayed about describing a circle of 20 feet radius above the water. Then plunging into the depths naught would be visible but the foam caused by the disappearing mass of life. Should several have appeared together we can easily imagine tall flexible forms rising to the height of the masts of a fishing fleet, or like snakes twisting and knotting themselves together. This extraordinary neck (for such it was) rose from a body of elephantine proportions. The limbs were two pairs of paddles like those of the plesiosaurus, from which this diver chiefly differed in the arrangement of bones in the breast."



STUDY OF AMERICAN SAURIANS.—Drawn by J. Carter Beard.

In the elasmosaur shown in the accompanying illustration (Elasmosaurus platurus) the neck represents a length of 22 feet in a total length of 50 feet.

The other animal shown in the water is a mososaur. The general appearance and the habits of mososaurs have been much misunderstood and their size has been exaggerated. The largest of these reptiles, Mososaurus horridus, depicted in the accompanying illustration, was certainly not more than 50 feet long. The skeletons of mososaura, found in the fossil beds of North America, do not average more than from 16 to 20 feet in length. Their proportions have always, up to the present time, been described as serpent-like, and they have been called sea serpents. That they anticipated a number of the anatomical peculiarities of the serpents cannot be denied, but their shapes, as is convincingly shown by an almost complete medallion skeleton upon a slab of rock with the bones scarcely displaced, in the New York Museum of Natural History, were no more snake-like than are those of alligators.

Like the elasmosaurs they had two pairs of paddles. These paddles had webbed digits and were attached to the body in such a manner as to admit considerable freedom of action. Their tails were flattened and much longer than those of the elasmosaurs. Their heads were flat, as are the heads of alligators, and wedge-shaped. Their mouths, armed with four rows of formidable teeth on the roof of the mouth, besides those in the lower jaw, opened so widely, being jointed very far back between the ear and the chin, that though they had not the expandable throats of serpents they could have found no difficulty in swallowing their prey alive. They were covered with small scales like those of a lizard or serpent. Strange to relate, a portion of the scaled hide of a mososaur has been discovered in an excellent condition of preservation. The tongues of mososaurs were long and forked.

THE HABITS OF ELASMOSAURS AND MOSOSAURS.

Elasmosaurs were beasts of prey and without doubt lived upon whatever they could seize and kill, principally fish, for they were more likely to capture them than they were to take other prey, and fish bones and scales are found associated with their remains.

They had long paddles and were built for speed. Prof. Cope fancies that they may have secured and held their prey with their forward paddles. Elasmosaurs were exclusively marine animals. It is not probable that they ever came ashore.

Mososaurs were more formidable reptiles than were elasmosaurs. It is not probable that any animal living during the existence of their type could have withstood their attack. It is possible that mososaurs may have come ashore occasionally voluntarily, but it is problematical. From their plan of structure it is evident their prey must have been the largest creatures that inhabited the waters in which they swam, and it is not at all unlikely they may have attacked and sometimes devoured plesiosaurs and elasmosaurs, as well as smaller species of mososaurs and the great marine turtles of that day.

Converting Salt Cake into Caustic Soda.

A cheap and expeditious method of converting salt cake into caustic soda has been devised by Mr. A. Brand, of London. The process consists of treating the black ash resulting from the first process of the furnace product with a quantity of carbonate of lime, and if necessary carbon is also added in limited amount. The mixture is then submitted to a high temperature. The carbonate by this means is converted into oxide of lime, and the carbonate of soda in the black ash into oxide of soda, while any sulphide of soda that may be present is also converted into oxide of soda. When the furnace product is lixiviated in hot water, there results a strong solution of caustic soda. A further hot water bath will remove the remainder of the caustic soda from the furnace product, and the solution that is left constitutes the liquid for lixiviating the next quantity of furnace product.

The Current Supplement.

The current SUPPLEMENT, No. 1347, has a number of unusually interesting articles. "The Georges Richard Automobiles" describes in great detail the construction of a typical French carriage, including a numbered section of the motor. The East River Bridge Report is continued and is accompanied by a number of diagrams showing the plans recommended. "The Autoplate—An Automatic Stereotyping Machine" describes one of the most clever inventions in the printing trade. The subject is well illustrated. A description, with illustration, of a new powerful English locomotive is given. A new excavator for digging trenches is illustrated. "Two-Tray Development" is by L. E. Farrand.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

SEPARATOR.—Benjamin B. Newman, Tampa, Fla. It is well known that when the shell is removed peanuts are still enveloped by a brown skin or husk. The present invention provides a machine for the removal of this skin. A rubber-faced roller working against a breast serves to loosen the husks. Below the roller a shaking-screen is arranged, over the left-hand side of which the peanuts with the hulls removed are discharged into a chute, and thence delivered to any suitable receptacle. The hulls are blown out by an air blast.

SEED-PLANTER.—Martin Everhart, Austin, Texas. The seed-planter is designed particularly for planting corn. The principal feature resides in the measuring and dropping devices, which comprise a wheel mounted on the frame of the planter and having its periphery running on the ground. The hub and spokes of the wheel are hollow, and each of the hollow spokes communicates at its inner end with the interior of the hub through the medium of a box which contains devices for measuring and uniformly delivering the grain to the hollow spokes, through which it is dropped into the earth.

DRAFT-EQUALIZER.—Arthur A. Hamilton, Ocheyedan, Iowa. The draft-equalizer is especially adapted for use with gang-plows, and is capable of effective work at either the right or left-hand side of the gangs. One horse will walk in the furrow and four horses on the stubble, each horse being compelled to do an equal amount of work.

Electrical Apparatus.

SWITCH FOR ELECTRIC CONDUCTORS.—Theodore B. Shaffer, Westmoor, Pa. This improved switch for suspended electrical conductors insures the proper passage of the trolley from the siding to the main line. The construction comprises a main line rib, a siding rib, terminating at its inner end opposite the main line rib, and a trolley-supporting surface extending beyond the inner extremity of the siding rib.

Apparatus for Special Purposes.

FIRE-EXTINGUISHING APPARATUS.—Alexander Logan, North Sydney, Nova Scotia, Can. Mr. Logan has provided a system of perforated pipes having valves arranged to be opened by weights or other pressures when released by the burning away of supporting cords or cables. The invention is characterized by its simplicity and apparent efficiency.

EXERCISER.—William W. Sloan, Jr., Buffalo, N. Y. The exercising device is designed for developing the muscles of the wrists and arms, and consists, briefly stated, in two hand-blocks connected to turn relatively to each other. A friction device bears between the blocks, so that by relatively turning them the various muscles of the arms and wrists are brought into play and thereby developed.

OPERATING-TABLE.—Albert Taubert and Richard Kny, Manhattan, New York city. The operating-table is constructed in three sections—two end sections and an intermediate section. Each section can be independently adjusted; and the sections can be so locked together that they can be collectively adjusted. These various adjustments are effected expeditiously.

Tools.

CUTTER-HEAD.—Charles H. West, Estabutchie, Miss. The inventor has devised an arrangement by which the cutters or bits are held securely and in a position properly to form the tongue without splitting or tearing the wood. The essential feature of the invention is to be found in two sets of bits, the members of each set of which are arranged in peripheral alinement. The two sets work together on each side of the tongue of the plank. All the parts are capable of easy access; and the device can be taken apart for repair or adjustment.

TUBE CUTTER AND EXPANDER.—William Canton, Paris, Ill. This boiler-tube-cutter comprises few parts, all of which are readily accessible and work without the use of springs. It has been the inventor's prime purpose to reduce friction as much as possible. The body of the tool is inserted in the tube so that a collar abuts against the head of the boiler. By turning a nut the tool-carrier is forced outwardly against the tube. When the cutter has cut through the tube, the entire tool is rotated. This causes the cutter to revolve along the inner surface of the tube and to sever the tube. Rollers bear against the tube on the side opposite the cutter and materially reduce the friction.

Mechanical Devices.

LEADER-FORMING MACHINE.—Lawrence A. McCarthy, Savannah, Ga. By means of this leader-pipe-forming machine, leaders can be rapidly formed from a flat sheet of tin or other metal up to the point of soldering the joint. The characteristic features of the invention are a mandrel, swinging dies for forming the opposite lap edges of the leader, means for swinging these dies in opposite directions, and devices for turning the leader-forming metal or sheet around the mandrel.

FIREARM.—Karl K. Bjerkness, Kaslo, B. C., Can. The subject of the invention is an attachment for firearms which is connected with a lever in the magazine-chamber and which is so related to the muzzle of the barrel that, through the expansion of the gases escaping from the barrel, the device will automatically operate the lever in question when the charge is fired. The empty shell is thereby extracted, a new shell brought in position for firing, and the hammer carried to a firing position, all without the assistance of the marksman.

ROLLER-MILL FOR CRUSHING AND GRINDING.—Johannes C. Wegerif, 45 Woburn Place, London, England. The mill consists essentially of internal and external revolving grinding-surfaces, having their axes of revolution oblique the one to the other and in different planes, so that the planes of revolution will be oblique and a disruptive as well as a crushing action produced. The one surface is formed by the interior of a revolving ring and the other by the exterior of a revolving roller working within the ring.

Vehicle Accessories.

STORM-FRONT FOR BUGGIES.—Arthur A. Prall, Dayton, Iowa. Mr. Prall has improved the construction of storm-fronts which he patented last year. The improvement is such that the device is rendered more compact, strong, and light. The improved storm-front is made in sections separable, one from the other. These sections can be stored away in the body of the buggy or at the dash. The upper section can be droped down so as to hang close to the dash, the lower section remaining connected with the body of the vehicle. A window is placed in the upper section, which window opens in an upward direction and is automatically carried to the upper position when released from engagement with its latch.

ELASTIC TIRE.—William F. Williams, 17 and 18 Great Pulteney Street, London, W., England. The tire is of D-section and adapted to be secured to the wheel-rim by a band passing through the bore of the tire. The invention has for its object to facilitate the longitudinal compression of the tire, particularly the base portion thereof, when lapping it around the wheel-rim, so that the tread of the tire will not be put in tension. This object is obtained by forming the walls of the bore of the tire with grooves extending circumferentially of the bore, the grooves being either helical convolutions or separate grooves, each lying in a transverse plane.

ELASTIC TIRE.—William F. Williams, 17 and 18 Great Pulteney Street, London, W., England. The invention relates to the same class of tires as that refererd to in the previous notice. A cord is embedded in the rubber, the cord being either in the form of a continuous helix or an independent convolution extending around the bore of the tire. With the cord a reinforcing strip of open-meshed fabric is combined, which fabric bridges the intervals between the cord convolutions when spaced as described, and serves as a guide for insuring uniformity of spacing in winding.

Fasteners, Hinges, etc.

FRICTION-HINGE.—Valentine C. Luppert, South Williamsport, Penn. The friction-hinge is of that class particularly adapted for supporting mirrors, swinging screens, transoms and the like. The pintle is attached to the swinging frame. The friction-hinge or holder consists of a spring plate or leaf having a transverse corrugation and a slot extending on opposite sides thereof, and a smaller leaf adapted for insertion in the slot and engagement at the ends thereof. The plates apply elastic pressure to the pintle, which is held between them.

COMBINATION-LOCK.—William E. H. Morse and Oliver H. Bemis, Algona, Iowa. The invention has for its object to provide a new and improved combination door-lock arranged to permit the owner readily to set the outside knob to a desired combination in order to prevent the opening of the door. The combination can be rendered ineffective whenever it is desired to use the door-lock as an ordinary lock. The device can likewise be used for sounding an electric alarm on the door-bell.

SHUTTER-BLIND FASTENER.—Jules D'Echaux, Gibson, La. The inventor has devised a contrivance for holding the slats of window-shutters at any adjustment desired. A disk or plate of peculiar construction is fastened to one of the slats through the medium of flanges. The disk works with a spring-bolt mounted on the framing of the shutter.

SASH-LOCK.—John P. Geraghty, Jersey City, N. J. The invention relates to window and door buttons; and its object is to provide a new and improved sash-lock which is readily applied and arranged automatically to lock the closed sashes in order to prevent burglars from opening the lock on the outside of the window. The sashes can be drawn securely together to prevent rattling.

Miscellaneous Inventions.

HAIR-BRUSH.—Emile Bick, 107 Gold Street, Buffalo, N. Y. The invention is a hair-brush provided with a passage or socket for holding a comb. A circular mirror is secured on the back of the brush.

FLYTRAP.—James Manning, Marathon, Texas. A simple construction has been devised by which the flies are trapped and caged and then disposed of. The trap is arranged for adjustment beneath a window-sash or beneath a fly-screen. The flies are attracted, pass into the trapping-chamber and then into the cage.

TENT.—Thaddeus D. McCall, 7 Monroe Street, Chicago, Ill. Mr. McCall has devised an improved portable floor tent designed for the use of one or two persons. The tent is of such small proportions and light weight as to be easily carried as a part of the bodily outfit and especially adapted to the needs of the hunter, prospector, civil engineer, or soldier.

ROLLER-SKATE.—Paul Jassmann, Brooklyn, New York city. The roller-skate is of that class in which a foot-rest is geared with one of the wheels and is moved downward by the weight of the skater and upward by a spring. The skate is easily attached to the foot and is arranged to transmit the downward motion of the foot-rest to one of the wheels in order to attain a high rate of propelling speed.

TRAHLACTOR.—William H. Martin, Manhattan, New York city. This breast-pump is characterized by the efficiency in drawing the milk from the glands; absence of mechanical irritation during use; and the fact that mechanical construction is such that the parts can be separated, thoroughly cleaned, and reassembled, without difficulty. This is extremely important, as the instrument can be made perfectly antiseptic before use, thereby obviating any possibility of the contraction of disease.

CALENDAR.—Herman F. Rueger, Brooklyn, New York city. This calendar is simple, and is arranged to permit the ready change of the dates for each month, the date of the month and the day of the week being very distinctly indicated.

SCREEN.—Albert Taubert, Manhattan, New York city. The purpose of the invention is to provide a simple, strong and light screen to which any material capable of folding is attached. The frame can be conveniently closed when not in use or enlarged horizontally. To secure this end lazy-tongs are used to connect the uprights of the screen.

CANE-UMBRELLA. — Grace A. Geiger, Brooklyn, New York city. The patent describes a case for covering umbrellas when closed. The usual leather case is neatly and effectively secured in place so as to give the umbrella the appearance of a cane.

LEAD FOR SETTING STAINED GLASS.—Jacob Pfleging, Bronx, New York city. The lead is provided with stiffening devices at each side of the heart whereby the lead is prevented from bending under ordinary strains. A novel means is provided for connecting or joining the leads with one another.

NECKWEAR-FASTENING. — Bertha J. Koehler, Brooklyn, New York city. The fastener is particularly adapted for the use of women to hold in position ribbons, bows and stocks. The fastener is attached to the inner side of the stock or other article of neckwear at the back and front of the neck and connected with a collar-button on the collar-band.

LAMP-HANGER.—Charles D. Kemmerer, Weissport, Pa. This simple hanger can be readily turned in any direction and held at any desired angle between that of the axial line with its base and at substantially right angles to its base, thus providing a device particularly adapted for use in barber-shops, dentists' offices, workshops, and the like.

DUMPING-CAR. — William H. Holman, Durango, Colo. A simple and effective dumping-trip and gate or gate lock combined has been secured. The latch for securing the gate is constructed so as to serve also as a car-handle. The main shaft, which also operates as a detent, is arranged for operation to release the body of the truck and to release the latch, so that the latter can be adjusted out of engagement with the gate.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE STORY OF THE AMERICA'S CUP. How It Was Won in Cowes in 1851 and How It Has Been Defended for Half a Century by the New York Yacht Club. By Charles P. Tower. New York: The Rudder Publishing Company. 1901. 18mo. Pp. 156. Price 25 cents.

This opportune little work, from the pen of a yachtsman who for many years has been closely identified with yachting in Eastern waters, comes as a timely contribution to the literature of a subject which is just now of paramount interest. The comparative brevity of this booklet has rendered the work of the author one of discriminating selection, and he has succeeded admirably in including within its pages every event of vital interest in the half-century which it covers. The first chapter is devoted to a description of the contest of the "America" against an English fleet of schooners and cutters, in the memorable race around the Isle of Wight, in 1851. To every subsequent attempt on the part of the British yachtsmen to recover the Cup a separate chapter is devoted, in which the dimensions of each vessel are given and a description of the races sailed. This work is an excellent pocket compendium for the use of those who do not care for a more bulky and elaborate book.

Business and Personal Wants.

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Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 1503.—For manufacturers of labor-saving devices.

Gasoline Lamps and Systems. Turner Brass Works, Chicago.

Inquiry No. 1504.—For a 15 h. p. traction gasoline or kerosene engine for use on a dry, level farm.

"Perfect aluminium solder. Amer. Hdw. Mfg. Co., Ottawa, Ill."

Inquiry No. 1505.—For a company to put in water power plant including dams, turbines, dynamos, etc., in Arkansas.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 1506.—For manufacturers of hand power roller presses for rolling pennies into different shapes, and pressing subjects or lettering on both sides.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1507.—For a machine for cutting, shredding or grinding straw.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 1508.—For manufacturers of compressors for charging the flasks for compressed air motors.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1509.—For manufacturers of wrought iron or steel tinning pots.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1510.—For manufacturers of nails.

We make anything in sheet metal, any shape. Estimates free. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 1511.—For manufacturers of rubber weather strips.

Kester Electric Mf'g Co's, Self-fluxing solder saves labor, strong non-corrosive joints, without acid, Chicago, Ill.

Inquiry No. 1512.—For manufacturers of hydrogen gas balloons.

FOR SALE.—Patent office reports, from 1853 to 1871, inclusive, bound in cloth. Address Patent, P. O. Box 773, New York City.

Inquiry No. 1513.—For makers of the largest and best hydraulic ram.

Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 149 Varick, cor. Spring Streets., N. Y.

Inquiry No. 1514.—For parties to make a machine for the manufacture of carbon papers.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1515.—For the manufacturers of an automatic postage stamp machine.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1516.—For manufacturers of the most modern belt-stretching machinery.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1517.—For manufacturers of stills for making wood alcohol.

WANTED.—Parties to make cigar holder and pipe, with bone tip and amber mouthpiece screwing into tip with screw core. See patent 635,240. Address Pipe, Box 773, New York City.

Inquiry No. 1518.—For small aluminium castings and seamless aluminium 2-inch tubing.

WANTED.—Men with moderate capital to take exclusive agency for sale of aluminium gas tips and gas novelties. Sample lot sent on receipt of 25 cents in stamps. Gas Tip and Self-lighter Co., 298 Broadway, New York.

Inquiry No. 1519.—For parties dealing in ¾-inch marbles perfectly round, in different colors.

DESENISS & JACOBI, A. G., Hamburg, deep-well and pumping machinery manufacturers, are desirous to deal in modern pneumatic pumping systems, either for representation or acquiring inventor's rights. Heinrich Eisler, Hamburg, sub. B 6545.

Inquiry No. 1520.—For machinery for making butchers' skewers.

MECHANICAL SUPERINTENDENT WANTED.—Familiar with the manufacture of firearms on a large scale, possessing executive and mechanical ability. Address, stating age, experience and references, A, Box 2123 General Post Office, New York.

Inquiry No. 1521.—For manufacturers of machinery for cutting, splitting and bundling firewood.

PATENT FOR SALE.—My Fastening Device is for sale to any shoe eyelet manufacturer at a reasonable price. Address Mr. Wenzel Cesak, 665 7th St., Milwaukee, Wis.

Inquiry No. 1522.—For manufacturers of small hot-air or gas engines from ½ to 1 horse power.

FOR SALE—Patent No. 676,385, dated June 11, 1901. Track-cleaniug Attachment for Hand-cars. For copy of drawing and specifications, address

August Hagg,
P. O. Box 113, Eaton, Colo.

Inquiry No. 1523.—For machinery for handling pine needles and manufacturing pine needle fiber into various products.

FOR SALE—Steam engine and boiler, in good condition; 4 horse power, $65. Address Quick Returns, 19 East Main St., Fort Wayne, Ind.

Inquiry No. 1524.—For manufacturers of perforating typewriter type for use on a Remington machine.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8403) A. A. D. writes: In the past summer it has often been unpleasant to handle iron exposed to sun rays with bare hands. It is not easy to convince men who handle such burning bars of iron that such iron is not hotter than the air they breathe. Many well-informed engineers stoutly hold that iron does absorb heat from sun rays, and does become hotter than the air. To deny this is to rule the sense of touch out of court as a witness. Perhaps the editor of the SCIENTIFIC AMERICAN can turn his searchlight upon this matter, and perhaps many of his readers will disagree with his conclusions. If iron exposed to sun rays rises in temperature above surrounding objects, then it becomes a heat storage cell. I believe the accepted theory is that heat radiates from all objects at higher temperature to all objects at lower temperature until all are at one dead level of temperature. In this view iron in sunlight is not warmer than the surrounding air, and iron in water or in snow is not warmer or colder than the surrounding water or snow. Yet it is not easy to flatly contradict one's senses. If iron in the sunshine on a hot day is not hotter than the air, our senses decidedly deceive us. When this question was stated to Dr. H. W. Wiley, Chief Chemist of the U. S. Department of Agriculture, he at once replied, "Place a wooden rod, a glass rod, an iron bar, a copper bar in sunlight on a hot day. They soon acquire the same temperature, yet the wooden rod and the glass rod seem, to touch, not warmer than the air, because they are not good conductors of heat. The iron bar may be too hot to hold in the hand. The copper bar may seem still hotter, it may burn the hand, because it conducts heat rapidly. In a very cold day the wooden rod and the glass rod seem not colder than the air. The iron bar may freeze to wet fingers. The copper bar may seem yet colder, for it rapidly conducts heat from the hand, yet on the hottest day and on the coldest day all are at the same temperature." A bar of iron exposed to sun heat on a hot day does show a higher temperature than a thermometer not far away. This is partly, perhaps, accounted for by the black color of iron, for white reflects and black does not reflect heat rays. But this does not explain why it is that when the temperature of the air is say 98 deg. F. and the temperature of the bar of iron is also 98 deg., and the temperature of the human hand is also 98 deg., heat should rush from the iron into the hand, carrying the sensation of scalding, burning heat. If the iron has but 98 deg. temperature it must, in conveying heat to the hand, also at 98 deg., reduce its own temperature below 98 deg. It may be that the air, and all objects exposed to sunshine on a hot day, are at the same temperature, but it is not easy to convince one who handles iron on a hot day that it is a fact, if it is a fact, that iron is not hotter than the air. A. It is a very difficult thing indeed to convince people that the sense of touch is a very unreliable guide in reference to heat and cold, or relative temperature. An experiment which will unsettle one's faith in his feelings may be performed as follows: Take three dishes. Put into one ice cold water, into another hot water as hot as can be borne by the hand, and into the third a mixture of these two, so that it may have an intermediate temperature. This dish should be set between the other two. Put one hand into the ice water and the other into the hot water till each hand is well accustomed to the temperature of the water in which it is. Then quickly transfer both hands to the middle dish, the water in which will feel hot to the cold and cold to the hot hand. A second experiment will convince one that articles of the same temperature do not feel equally hot. Take a silver half dollar, a copper washer, an iron washer and a piece of wood, all of the same size and shape as near as may be. Place these in an oven till they have had time to acquire the temperature of the oven. Then reach one hand into the oven and test the several pieces one after another. The silver will feel hottest, next will come the copper, then the iron and last the wood, which may not feel hot at all, unless the oven is very hot indeed. A silver spoon from a cup of tea may burn the mouth when the tea which it contains will not. Such experiments ought to convince any one that the testimony of a reliable thermometer should be taken as final instead of speculations about what ought to be or seems to be the case. We are very certain that stones and iron in the sunshine become hotter than the surrounding air during the day and colder during the night, and that this fact explains the deposit of dew upon such articles. We also think that if the air were 98 deg. and a bar of iron in the air were 98 deg. the hand in the same position would not be 98 deg., since the hand is cooled by the evaporation of perspiration, which would be rapid at that high temperature. For that reason the iron would feel hot to the hand. An article cannot feel hot to a hand which is at the same temperature. It would certainly be very rarely the case that a thermometer laid upon the open skin exposed to the air would indicate 98 deg. Controversy upon such a matter ought not to be possible. The demand should be immediate: "To the experiment. Test the temperatures and find what they are."

(8404) C. U. M. writes: A claims that a rain gage, or pluviometer, of small diameter, say, from 4 inches to 6 inches, which stands perpendicular, will under all circumstances show the actual rainfall, while B maintains that the gage will show the actual rainfall only while the latter descends perpendicularly or nearly so, but that when it descends at an inclination it will show less, and that the greater the inclination the greater the difference between the actual fall and that shown by the gage. Which is right? A. The object of the rain gage is to collect the rain which would fall upon a certain area of the earth. This it does without reference to the angle of inclination of the descending drops. The same amount of water is collected as would fall upon a sheet of white paper or of soil of the size of the opening of the rain gage. We agree with A. Suppose the rain gage were made with a square opening, say, one square foot, and that each square foot of the surface of the earth upon which the rain falls were provided with its rain gage, the entire shower would be collected in the gages. Each gage would catch the water which otherwise would fall upon a square foot, no matter what the inclination of the falling drops. If B is right this ought not to be true when the rain falls obliquely. But the entire rainfall must be caught in the gages, and hence each gage must catch what falls upon its square foot, even when the rain falls obliquely.

(8405) A. K. S. asks: Please give me simple definitions in Notes and Queries of the following: A volt, ampere, watt, induction. A. These terms have been defined repeatedly in our columns. The volt is the unit of electrical pressure, the cause of the flow of an electric current. About one and one-tenth volts is the pressure of a Daniell's or gravity cell at its best. The ampere is the unit of current strength, and is such a current as would be given when the pressure is one volt and the resistance is one ohm. The watt is the unit of electrical power, the power given when the pressure is one volt and the current is one ampere. It is 1-746 of a horse power, or 746 watts will do the same work as a horse power. Induction is the effect of an electric current upon a wire in its neighborhood, setting up a current in the wire. There are numerous kinds of induction, however.

(8406) G. C. L. asks: Can you tell me if the quadrants of paper on a Toepler-Holtz electrical machine ought to be insulated from the tinfoil disks which they cover? A. The paper sectors should be in contact with the tinfoil, not insulated from it, on a Holtz machine.

(8407) J. C. P. asks: To settle a dispute kindly state in the Notes and Queries column of your valuable paper if the idea that lightning rods afford protection to buildings is not rapidly becoming obsolete. A. On the contrary, lightning rods are regarded as a great protection to buildings.

(8408) J. H. asks: 1. A few months ago I noticed that whenever I touched metal an electric spark with a crack passed off my finger to the metal, and in about ten minutes I could repeat the same again. For three or four successive days this occurred. Never before or since had I noticed same. During that time I was occupied with the same business as before and after. What caused the electric sparks? A. The spark was caused by the condition of the air. In dry cold weather it is very easy to obtain a spark by simply rubbing the shoes on the carpet as we walk and then presenting the finger to some object. The gas can be lighted in this way. 2. How is the electric current generated in the air? It cannot be through the rotation of the earth, as the atmosphere moves with earth, and between atmosphere and the empty space there can be no friction to produce it. A. We do not know.

(8409) H. B. writes: I notice in your issue of SCIENTIFIC AMERICAN for September 7 an article on the depth of the atmosphere surrounding the earth, which is variously estimated from 40 to 216 miles. I can understand how the depth of atmosphere could be estimated by its weight per cubic foot; but as there is no limit (apparently) to its elasticity, and as every foot ascension makes the same atmosphere rarer and necessarily occupy a greater space, and as far as we know from practice its density decreases at a given ratio as the height increases, how can there be a limit to the height the atmosphere reaches unless there is a limit to its rarity? I ask this question, not to dispute other assumptions, but to grasp the idea that would enable one to figure a limited height of the atmosphere. A. The older estimate of the height of the atmosphere was based upon the law of expansion of gases as the pressure is diminished. This law is that a gas expands in the same ratio as the pressure is diminished. If the pressure is halved the volume is doubled; if reduced to one-third, the volume becomes three times as great, etc., for any pressure. In addition to this the effect of temperature upon the air to contract it and prevent a portion of the expansion must also be allowed for. The temperature of the air falls one degree for every 300 feet of ascent above sea level. Allowing for both these laws, we have the result that if the barometer stands at 30 inches at the sea level, it will indicate 29 inches at an altitude of 910 feet above the sea level, and 28 inches at 1,850 feet. At 16,000 feet the barometer would stand at 16 inches, at 30 miles it would read five-thousandths of an inch, and at 45 to 50 miles the reading would be too small to be made. The mercury in the cistern and in the tube would apparently be at the same level. At that altitude the air has become so very thin as to be incapable of producing pressure sufficient to be measured by a barometer. But that is not the same as saying that there is no air above that level. Meteors are small bodies which are moving through space in exactly the same manner as the earth moves around the sun. Some of these encounter the earth in their flight and enter the earth's atmosphere. As they rush through the atmosphere they exert friction against the air just as a train of cars does, and as a result of the friction they take fire and are burned when they contain only gas. If they are solid they are heated and fall hot to the surface of the earth. Many of these have been collected. Some of them have been found while still hot from their rush through the air. If a meteor happens to be observed by two persons at a distance from each other and its angle above the horizon noted a triangle can be drawn which shall have the meteor at one corner and the observers at the other two corners. If the distance between the observers is known in miles, the other two sides of the triangle can be found also in miles; that is, the height of the meteor can be measured. In this way it is learned that meteors take fire at much more than 100 miles above the surface of the earth, and, of course, the air extends a considerable distance above that point, since the meteor had gone through air enough to heat it and set it on fire before it became visible. It is difficult to conceive of anything so thin as the air must be at these great heights, but we are compelled by the reasons given above to believe that it does so exist. That the air extends more than 100 miles above the earth is not a matter of estimate, but of measurement. How much farther it extends is a matter of estimate. The other question raised, How can there be a limit to the atmosphere unless there be a limit to its rarity? may be answered that there is a limit to its rarity. Matter is not infinitely divisible, though space may be. The limit to the rarity of the air is ultimately reached when the attraction of the earth, which we call gravitation, is unable to hold the molecules of oxygen and nitrogen upon the earth. The energy of these molecules keeps them in constant motion. They collide with one another and bound away without ceasing their motions. As we go above the earth the distance between the molecules of the gases becomes greater through which they must move before they strike another molecule. At the greatest heights the molecules in the outer layer may move away from the earth and be lost to it, passing away into what we erroneously call *empty* space. From such considerations it is thought that the heavier gases of the air are more abundant near the surface of the earth and the lighter ones extend higher above the earth. It may even be that there have been gases in the atmosphere which have now entirely escaped from it. And the processes may be still going on. We have not reached the limit of knowledge even in regard to so common and free a thing as the air we breathe.

(8410) J. M. C. asks: 1. What do you consider the best compound for pouring on wires of a newly-wound armature to act as an insulator? A. Shellac. 2. How may I run a 110-volt motor on a 500-volt circuit? A. If the motor is a small one, it can be run with a resistance made of lamps; if more current than a lamp bank will furnish is required, you will have to rewind the motor. 3. How may I ring electric bells (run on battery) from a 500-volt circuit? Have you SUPPLEMENT containing such a diagram? A. Put the bell in series with five incandescent lamps requiring 100 volts each. The bell will probably get voltage enough through the lamps. 4. How should I regulate the pressure of a trolley pole against the trolley wire? I mean by this how may I know when the pressure is too great or not enough? A. The pressure is regulated by a spring. 5. Where should the trolley wire be on a curve—in the center of the track, near the outside rail or near the inside? A. The wire is as nearly as may be over the center of the track. The book upon "Electric Railways," by Dawson, price $12.50, gives full details upon most points in the construction and operation of trolley lines. "The Electrical Railway Pocket Book," by the same author, price $5, is valuable.

(8411) A. D. asks: Is the voltage of circuits cut down when a rheostat is used, and is it cut down when a lamp is used? I am burning a 105-volt lamp in series with a water rheostat on a 210-volt alternating circuit. Does rheostat cut down the voltage to 105, or does it simply cut down the amperage? A. The voltage of a circuit is not affected by a rheostat. From one pole of the circuit to the other in the case you cite is 210 volts. If you had two 105-volt lamps across that circuit half the drop would be taken by one lamp and the other half by the other lamp. Your rheostat simply takes the place of one lamp, and in the rheostat there is done exactly the same electrical work which would be done in the lamp if it were put in place of the rheostat. The current which flows through the rheostat heats water to a certain degree. The same current would heat a lamp so that it would shine. If your lamp takes a half ampere, you pay for a half ampere at 110 volts. You get light for a half ampere at 105 volts and waste in the water one-half ampere at 105 volts. Without the rheostat you could not put a single lamp on the circuit. Alone it would get a whole ampere, and that would burn the lamp out immediately. The rheostat adjusts the resistance of a circuit to the work to be done and enables one to change the current as desired.

(8412) H. V. asks: Can I obtain a steady current of about 100 volts from 15 Grove cells by passing the current through an induction coil? If not, please advise me as to how to get a current of about 100 volts as steady or continuous as possible without using a dynamo. A. You cannot obtain a continuous current by an induction coil in any known way. The induction coil gives either an alternating current or a pulsatory unidirectional current according to circumstances. To obtain a 100-volt continuous current with a Grove battery will require from 50 to 60 cells connected in series. This will be as steady as that of a dynamo.

(8413) C. H. A. asks: Will you please explain how, if I know the power of each lens, I can find the combined power of two or more, as in a microscope or telescope? Should not one rule apply to either microscope or telescope if there is no difference other than the high-power objective in one and the very low power in the other? A. In obtaining the magnifying power of a microscope, the fact is used that the limit of distinct vision by the eye is normally ten inches. The linear magnifying power of the objective and of the eyepiece is found by dividing ten inches by the focal length of the lens. Thus a half-inch objective magnifies a line 20 times. The lens is said to magnify 20 diameters. A 2-inch eyepiece magnifies 5 diameters. The total linear magnifying power of the two lenses combined is the product of their separate magnifying powers. In the case above this would be 20 by 5, or 100 diameters. The magnifying power of a telescope is the quotient found by dividing the focal length of the object glass by that of the eyepiece. An object glass whose focal length is 6 feet, or 72 inches, with an eyepiece of 2 inches focal length will magnify an object 36 diameters. The superficial magnification will in both instruments be found by squaring the linear magnification.

(8414) W. O. B. asks: Will you kindly inform me if winding should be changed in motor described in SUPPLEMENT No. 641 to run on 110-volt circuit, or would it be advisable to use resistance coil? A. A rheostat may be used or the winding may be changed, using No. 28 B. & S. on field and No. 30 on armature.

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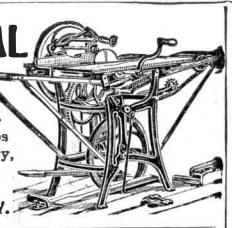

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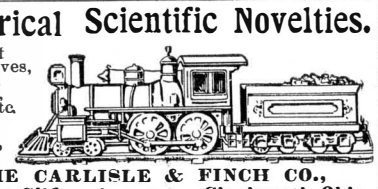

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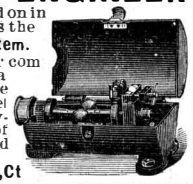

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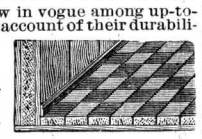

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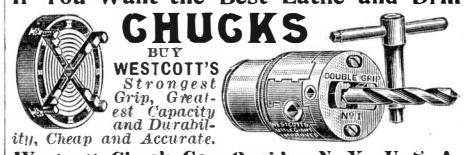

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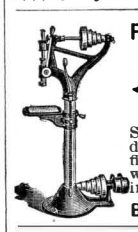

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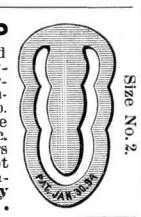

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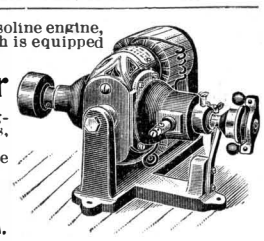

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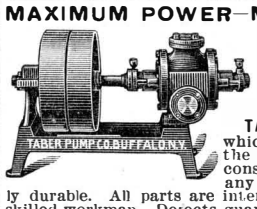

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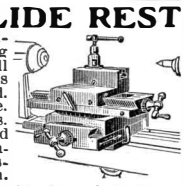

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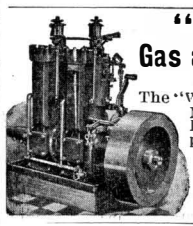

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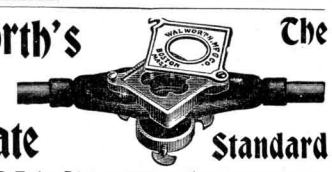

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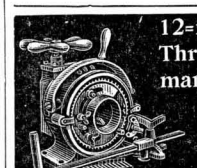

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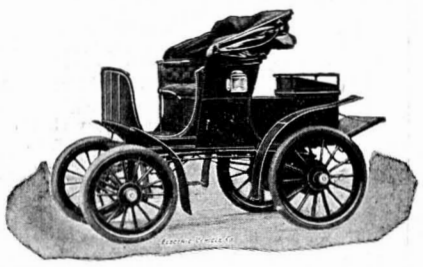

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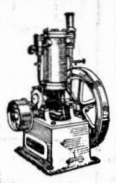

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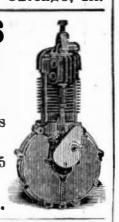

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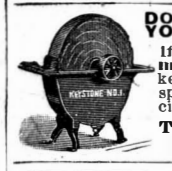

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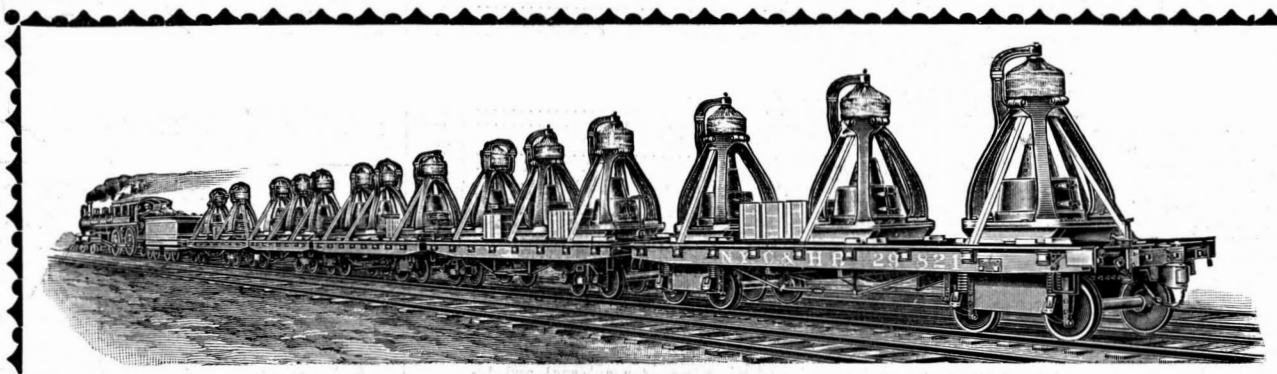

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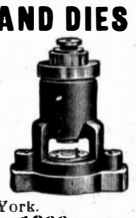

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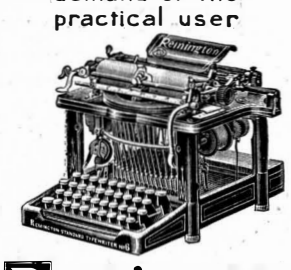

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